NORTH AMERICAN SPECIES OF THE GENUS MIDEOPSIS (ACARINA: MIDEOPSIDAE)[1]

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INTRODUCTION

The first member of the genus reported from North America was *aspera* described by Wolcott (1900) as belonging to a new genus *Xystonotus*. Most workers now agree the latter is best considered a subgenus of *Mideopsis*. Marshall (1940) described *M. americana* primarily from material taken in the Great Lakes area. Lundblad (1941) gave short preliminary descriptions (without illustrations) for three species from Michigan and Wisconsin, *lamellipalpis*, *fibrosa* and *rosea* (the latter appears to be a synonym of *americana*). I have examined the types and redescriptions are included. Hoff (1944) named *Xystonotus reelfootensis* , based on material from Reelfoot Lake, Tennessee. This species actually belongs to the subgenus *Neoxystonotus* and is presently the only known member of that subgenus occuring in North America. Habeeb (1954) published on two new species of *Xystonotus*, *M. robusta* and *M. delicata*. This same author (1958) described *borealis*, *meridionalis* and *neoorbicularis* as subspecies of *orbicularis*. The last of these subspecies, *neoorbicularis* apparently is a synonym of *fibrosa*. Later, Habeeb (1962) raised *borealis* to a full species, included *meridionalis* as one of its subspecies and described an additional subspecies, *M. borealis senator*. For reasons to be discussed later, these two subspecies are here synonymized. In the same paper Habeeb also described the very unusual species *M. gladiator*. All of these species erected by Habeeb were based on material collected in Northeastern North America. The following year, Habeeb (1963), published a new species *Xystonotus expositor* from southern California. Cook (1974) described a divergent member of the subgenus *Xystonotus*, *M. pumila*, from interstitial waters in Western North America. Habeeb (1975) has proposed the new genus *Herbsmideopsis* for the latter species but this taxon is placed in synonymy in this paper. Ian Smith (personal communication) has collected a new species belonging to the subgenus *Nudomideopsis* in Ontario and is in the process of describing it. The subgenus (but not the species) is included in the key.

Thirteen new species and subspecies are proposed in the present work bringing the total described North American forms to twenty five. Types have been examined for all species except those proposed by Herbert Habeeb.

[1] Contribution No. 355 from the Department of Biology, Wayne State University. Both the work and publication of this paper supported in part by a grant (GB-6475) from the National Science Foundation.

Unfortunately, many of the latter are very poorly described and illustrated. I have taken some specimens at or near the type locality and additional mites from Northeastern or Northcentral North America are known from habitats similar to those of the type localities. With this material most of Habeeb's species may be recognized with a reasonable degree of certainty. One exception is *M. expositor* (Habeeb). I apparently have no specimens of this species and, because of the completely inadequate drawings and description, cannot even place it in a subgenus with confidence. Habeeb's illustration of the dorsal view of *expositor* has been redrawn and his description included in the text of this paper. However, it was impossible to incorporate it into the key to species.

Pigmentation of the dorsum (or lack of it) seems a rather stable species characteristic in the subgenus *Xystonotus* but appears to be highly variable in certain members of the typical subgenus. Since we presently do not know the function of color patterns in water mites, there is little to be gained in speculating on the "why" of this variability in some species. It should be pointed out that the color of a cleared dorsal shield may bear little relation to the color pattern in life, for this will also be influenced by the white of the guanine crystals in the excretory organ and the darker colors of the gut contents. In spite of this occasional variability, the pigmentation of the dorsal shield is sufficiently useful that clearing specimens in dilute KOH is recommended in order to preserve it. In presenting measurements those of the holotype and allotype are given first. If a series of specimens is available, the range of variation is given in parentheses following the measurements of the primary types. Only the more important synonymy is given for previously described species. Anyone wishing a complete synonymy should consult Viets (1956).

Thanks are expressed to Drs. David Barr and Ian Smith for the chance to examine species of *Mideopsis* in the collections of the Royal Ontario Museum. The late Dr. O. Lundblad loaned me his types of the North American species and Dr. Kurt O. Viets kindly supplied specimens of European members of the genus for comparison. The photographs were taken by Roman Romach and Francis Sanders. Holotypes and allotypes, unless otherwise indicated, will be placed in the Field Museum of Natural History (Chicago).

KEY TO THE NORTH AMERICAN SUBGENERA AND SPECIES OF MIDEOPSIS

1. Epimeroglandularia 1 located far forward on the second coxae; genital acetabula widely separated from each other on their respective sides. . . . . Subgenus Nudomideopsis Szalay (a new species from Ontario, the first record from the New World, is presently being described by Ian Smith, and is not included in this paper).

   Epimeroglandularia 1 located near posterior margin of second coxae (figs. 4, 17, 28); genital acetabula nearly touching on their respective sides (figs. 4, 29, 58). 2

2. Epimeroglandularia 2 located anterior to the gonopore (figs. 4, 11, 25); swimming hairs present. 3

   Epimeroglandularia 2 located in a line with the anterior end of the gonopore (fig. 57), more posteriorly (figs. 45, 58) or actually absent (fig. 74); swimming hairs absent. Subgenus Xystonotus Wolcott 15

3. Two pairs of conspicuous glandularia placed relatively close together on their respective sides posterolateral to the gonopore (figs. 34, 38); P-II and P-III with a few very short setae (fig. 35); male with a pronounced sexual dimorphism of the fourth leg (fig. 37); female with genital acetabula as wide as or wider than long (fig. 38). . . . . Subgenus Neoxystonatus Lundblad (only known North American species, M. reelfootensis (Hoff) . . (p. 118)

One pair (fig. 25) or no (fig. 23) conspicuous glandularia posterolateral to the gonopore; P-II and P-III with several longer setae (figs. 22, 23); no sexual dimorphism of the male legs and genital acetabula wider than long in the female.
Subgenus Mideopsis Neuman 4

Key to the species of the subgenus *Mideopsis*

4. Anterior two pairs of coxae terminating in recurved hook-like processes (fig. 11); dorsal shield with a pointed projection (fig. 13). . . . . M. gladiator Habeeb . . . . . (p. 115)

Anterior two pairs of coxae "normal" (figs. 4, 7, 9); dorsal shield without a pointed projection. 5

5. Setal tubercle on ventral side of P-IV short (figs. 22, 24) to moderately developed (fig. 2); dorsal shield without a pair of lateral ridges (figs. 79-95); setae flanking the female gonopore located on sclerites fused with the ventral shield (figs. 9, 17).
M. orbicularis-species group 6

Setal tubercle on ventral side of P-IV moderately developed (fig. 30) to well developed (fig. 31); dorsal shield usually with a pair of lateral ridges (figs. 96-100); setae bearing area flanking the female gonopore located on sclerites separated from the ventral shield (fig. 29). M. crassipes-species group 13

6. Cuticle on ventral side of P-IV distal to the setal tubercle appearing two layered (figs. 16, 21, 22, 24).
M. americana-species subgroup 10

Cuticle on ventral side of P-IV distal to the setal tubercle not appearing two layered (figs. 2, 6, 10).
M. orbicularis-species subgroup 7

7. Ventral tubercle on P-IV relatively well developed (fig. 2).
M. jacunda, new species. . . . (p. 109)

Ventral tubercle on P-IV much shorter (figs. 6, 10). 8

8. Body relatively large (females 942μ-1140μ in length, males unknown); second leg with many swimming hairs, first leg with a few swimming hairs. . . . M. fibrosa Lundblad . . . . . (p. 110)

Body relatively small (females 684μ-866μ in length, males 668μ-836μ in length); second leg with two or three swimming hairs, first leg with no swimming hairs. 9

9. Color pattern of the dorsal shield forming a complete V-shape (fig. 87). . . . . M. borealis californica, new subspecies . (p. 108)
Color pattern on the dorsal shield variable (figs. 79-86), but not forming a complete V-shape. . M. borealis borealis Habeeb (p. 107)

10. P-IV with a noticeable distal bowing, setae on ventral tubercle of P-IV relatively large (figs. 16, 21). 11
P-IV without a noticeable bowing distally, setae on ventral tubercle of P-IV relatively small (figs. 22, 24). 12

11. Dorsal side of P-IV with a pronounced bowing (fig. 16); seta on ventral side of I-Leg-4 well developed (fig. 18, arrow). M. americana Marshall. . . . (p. 110)
Dorsal side of P-IV only slightly bowed (fig. 21); seta on ventral side of I-Leg-4 short (fig. 19, arrow) or absent. M. olseni, new species . . . . (p. 112)

12. P-IV relatively long and with little development of a setal tubercle (fig. 22). . . . . M. marshallae, new species . . . . . (p. 114)
P-IV relatively short and usually with some development of a setal tubercle (fig. 24). . M. lamellipalpis Lundblad . . . . . (p. 113)

13. Setal tubercle on ventral side of P-IV long and directed more or less ventrally (fig. 31); fourth and fifth segments of the third and fourth legs each with a single short swimming hair. M. barri, new species . . . . . (p. 118)
Setal tubercle on ventral side of P-IV shorter and directed more or less distally (fig. 30); third and fourth legs with several swimming hairs. 14

14. Dorsal shield narrowed anteriorly (figs. 97, 98, 100). M. crassipes Soar . . . . . (p. 115)
Dorsal shield not noticeably narrowed anteriorly (fig. 99). M. laversi, new species . . . . (p. 117)

Key to the species of the subgenus *Xyxtonotus*

15. Dorsal shield with a pair of distinct lateral ridges (fig. 103). 16
Dorsal shield with a more medially located V-shaped area of smaller or no body pores (figs. 110, 112, 113) (do not confuse this with the distinct ridges described and illustrated in the other portion of this couplet). 19

16. P-II nearly as long as P-IV (fig. 43); dorsal rim of ventral shield relatively wide; color patches of dorsal shield separated into right and left halves (fig. 104); inhabiting lakes. M. aspera (Wolcott) . . . . . (p. 119)
P-II much shorter than P-IV (figs. 44, 50); dorsal rim of ventral shield much narrower; color patches of dorsal shield (if present) fused posteriorly (figs. 105-107); inhabiting streams, including interstitial water 17

17. Small (females 421μ-486μ in length, males 364μ-399μ in length); integumental pigmentation light (fig. 107); found in interstitial waters. . . . . M. interstitialis, new species . . . (p. 121)
Larger (females 502μ-562μ in length, males 449μ-486μ in length); integumental pigmentation much darker (figs. 105, 106); found in the surface waters of streams. 18

18. Female with a relatively wide body and distinct projections at the posterior end of the ventral shield (fig. 54).
M. vicina, new species . . . . (p. 122)
Female with a proportionally narrower body and without the pronounced projections at the posterior end of the ventral shield (fig. 40). M. delicata (Habeeb) . . . . . (p. 120)

19. Epimeroglandularia 2 absent (figs. 73, 74); setae on P-II and P-III greatly reduced in number (fig. 75); medial margins of fourth coxae very long. 20
Epimeroglandularia 2 present (figs. 57, 58); setae on P-II and P-III not reduced in number (fig. 53); medial margins of fourth coxae typically reduced (fig. 57) but rarely may be well developed (fig. 70). 21

20. Setal tubercle on P-IV somewhat pointed (fig. 75); P-V relatively short (fig. 75). . . . . M. pumila Cook . . . . . (p. 127)
Setal tubercle on P-IV decidedly truncate at tip (fig. 78); P-V relatively much longer than in the related species (fig. 78).
M. pallida, new species . . . . . (p. 128)

21. Dorsal shield with a distinct median ridge (fig. 109).
M. lamprima, new species . . . (p. 123)
Dorsal shield without a median ridge (figs. 110, 112). 22

22. Dorsal shield with distinct longitudinal striations and a color pattern (fig. 110). . . . . M. robusta (Habeeb) . . . . . (p. 124)
Dorsal shield lacking longitudinal striations and a color pattern (figs. 108, 112). 23

23. P-IV relatively long and narrow, setal tubercle of this segment truncate (fig. 64); found in the surface waters of streams.
M. wolcotti, new species . . . . (p. 125)
P-IV relatively short and stocky, setal tubercle on this segment more or less pointed (fig. 66); found in interstitial waters. 24

24. Medial margins of fourth coxae of moderate length (fig. 67).
M. sabulonis, new species . . . (p. 125)
Medial margins of fourth coxae relatively long (fig. 70)
M. paramecia, new species . . . (p. 126)

SPECIES DESCRIPTIONS

The Mideopsis orbicularis-species group

The type species of the genus *Mideopsis* is the European *M. orbicularis* (Müller). This species and *M. ryugaensis* Imamura (Japan) are the only Old World members of its group but there are many species in the New World. *M. orbicularis* has been reported from North America but all previous records are suspect. All specimens assigned to *orbicularis* that I have examined can be placed in one of the species listed in this paper. In addition to the eight forms treated here, I have seen several additional species from Mexico and Costa Rica. The group is yet to be recorded from South America. The *orbicularis*-group is characterized by a rather uniform morphology of the ventral shield which is better illustrated (figs. 4, 7, 9, 14, 17, 20, 23) than described. There are no obvious glandularia posterolateral to the gonopore and the setae bearing area flanking the gonopore is fused with the ventral shield in both sexes. The dorsal shield lacks pronounced longitudinal ridges and the palp has the setal tubercle on the ventral side of P-IV varying from poorly to moderately developed and placed very near the middle of the segment. Because of these similarities of the venter, drawings of only one sex are included for each species. The morphology of the genital field will be very much like that shown for that same sex in one of the related species.

The European *Mideopsis orbicularis* is variable in size, color and habitat types (it is known from both streams and lakes) and some of the North American species also exhibit this wide variation, especially in color pattern. Figures 79-86 show the differences in pigmentation found in what appears to be a single species, *M. borealis* Habeeb. Figure 1 is a semidiagramatic composite of the structures and pigmentation centers which may be found in a member of the *orbicularis*-group. There appear to be three centers of pigmentation, a central area near the anterior end of the dorsal shield and a pair of lateral color patches. Any of these centers may increase or decrease greatly over that shown on the diagram. For example, figure 83 shows an extensive development of all three, figure 86 shows a loss of the anteromedial area and figure 80 shows a loss of the lateral pigment patches. Figures 81, 82, 84, 85 illustrate intermediate conditions. Not only does the extent of the pigmentation change but also the intensity may vary from dark to lighter to a condition in which it actually disappears. Even within the same population there may be a great variation, with patterns such as those shown in figures 80, 84, 85 being taken in the same collection. There may also be prominent ridges in the anterior portion of the dorsal shield. Commonly there is a semicircular median raised area (shown immediately anterior to the color patch in figure 1) and a pair of curved low ridges lateral to this median ridge. These three ridges vary from well developed to absent, even within members of the same population. The broken lines in the middle of figure 1 converging towards the posterior muscle scars are areas of somewhat thickened cuticle with smaller body pores. These latter areas may be prominent in some species (figs. 87, 92, 93) but absent in others (figs. 79, 88-91).

1. Mideopsis (Mideopsis) borealis borealis Habeeb

(Figures 4, 5, 10, 79-86)

Mideopsis orbicularis borealis Habeeb, 1958. Leaflets Acadian Biol., 17: 2.
Mideopsis orbicularis meridionalis Habeeb, 1958. op. cit., 17: 2. (new synonymy)
Medeopsis borealis Habeeb, 1962. op. cit., 25: 1.
Medeopsis borealis senator Habeeb, 1962. op. cit., 25: 1. (new synonymy)
Mediopsis borealis meridionalis Habeeb, 1962. op. cit., 25: 1.
Mideopsis meridionalis Habeeb, 1974. op. cit., 63: 2.
Mideopsis senator Habeeb, 1974. op. cit., 63: 2.

Female: Dorsal shield 608μ-790μ in length, 532μ-684μ in width; dorsal shield extremely variable in color pattern, some specimens exhibiting all three pigment centers (fig. 83), some with only the lateral pair (fig. 86), others with only the anteromedial patch (fig. 80) but most with pigmentation somewhere between these extremes; the anteromedial semicircular ridge (shown immediately anterior to the median color patch in figure 1) often well developed and associated with a general raising of the central area of the dorsal shield immediately posterior to it; this ridge and associated raised area varying in development down to complete absence of both; the short curved lateral ridges also exhibiting varying degrees of prominence; there is usually no development of the paired longitudinal thickened areas (shown in broken lines in figure 1) but these features slightly indicated in occasional specimens; ventral shield 684μ-866μ in length, 608μ-744μ in width; structure of ventral shield, other than genital field region, similar to that illustrated for the male; gonopore 68μ-88μ in width; three pairs of genital acetabula; capitular bay varying from V-shaped to somewhat U-shaped; dorsal lengths of the palpal segments: P-I, 26μ-34μ; P-II, 45μ-65μ; P-III, 28μ-38μ; P-IV, 59μ-79μ; P-V, 29μ-40μ; structure of palp as illustrated and described for the male; dorsal lengths of the distal segments of the first leg: I-Leg-4, 59μ-86μ; I-Leg-5, 86μ-121μ; I-Leg-6, 104μ-141μ; most of this size variation related to whether the animal is large of small, but there is variation in proportional stockiness of the segments as described for the male; several long swimming hairs present on the third and fourth legs.

Male: Dorsal shield 577μ-768μ in length, 510μ-634μ in width; dorsal shield as described for the female; ventral shield 668μ-836μ in length, 577μ-714μ in width; figure 4 illustrates the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, 24μ-33μ; P-II, 45μ-62μ; P-III, 28μ-35μ; P-IV, 59μ-83μ; P-V, 31μ-42μ; figure 10 shows the proportions and chaetotaxy of the palp; this figure illustrates one of the more stocky palps and there is a graded variation towards a condition in which the segments are proportionally narrower and the ventral tubercle of P-IV projects somewhat more; dorsal lengths of the distal segments of the first leg: I-Leg-4, 62μ-79μ; I-Leg-5, 88μ-117μ; I-Leg-6, 121μ-145μ; as in the female, much of the variation in segment length is related to differences in size of the animal, but there is also variation in stockiness; figure 5 shows a "typical" I-Leg-4-6 but the legs of some individuals are proportionally thicker and others more slender than shown.

Habitat and Distribution: This is primarily a stream inhabiting species but it moves into lakes in the more northerly portion of the range (collections from certain Ontario lakes in the Royal Ontario Museum contain these individuals). I have seen specimens from Ontario, New Brunswick, Maine, New York, New Jersey, Pennsylvania, Virginia, Georgia, Northern Florida and the Ozark Region (Missouri and Arkansas). The range in general seems to be in the clear streams of Eastern North America but the Florida population was from

one of slightly stained streams (a tributary of the Waccasassa River one mile south of Gulf Hammock, Levy County) typical of that area. The occurence of this species in the Ozarks is not unexpected for we find a similar connection with the Appalachian fauna in other stream inhabiting mites. What is surprising is its apparent absence in the northern parts of the Midwest (Michigan, Wisconsin and Minnesota) for these areas have streams which should provide an ideal habitat.

Discussion: As one examines the specimens assigned to this species it is difficult to believe that a single species would exhibit such variation in size, appendage segment proportions and color patterns. However, I have spent many hours going over long series of specimens and can find no consistent morphological or color differences which allow them to be separated even into different subspecies. Great variations in size and color may occur within the same population and these differences are found throughout most of the range. For example, a dorsal color pattern as shown in figure 80 occurs on individuals from Maine, New York, Virginia and southern Georgia. Some of the largest individuals as well as some of the smallest possess this color pattern. The possibility certainly exists that this great variation is masking separate species or subspecies but, if they do exist, techniques other than the use of classical promorphology will probably be needed to demonstrate them.

Habeeb (1962) illustrated dorsal color patterns similar to those shown in figures 85, 86 for "typical" *borealis*. *M. borealis meridionalis* has not been illustrated but, from the admittedly inadequate description, it would appear that the dorsal color pattern is much like that shown in figure 80. In the paper listed above Habeeb also described an additional subspecies, *M. borealis senator*, from material collected in New York. This latter is at the small end of size variation of the species and its illustrated color pattern would seem most similar to that in figure 81. Based on present evidence it seems best to synonymize these two subspecies names. Habeeb (1974) raised these two taxa to full species rank. If they have any validity at all, *meridionalis* and *senator* probably would be full species, but it is yet to be demonstrated that they are valid.

2. Mideopsis (Mideopsis) borealis californica, new subspecies

(Figure 87)

Female: Dorsal shield 738μ (729μ-738μ) in length, 593μ (593μ-631μ) in width; dorsal shield color pattern distinct from that of *borealis borealis*; the area indicated by the broken lines in figure 1 is well developed and pigmented; these lateral areas of pigmentation converge as they continue foward anterior to the median ridge area; figure 87 shows the typical color pattern: ventral shield 806μ (788μ-806μ) in length, 653μ (653μ-669μ) in width; structure of venter as shown for *borealis borealis*; gonopore 81μ-83μ in width; three pairs of genital acetabula; dorsal lengths of the palpal segments: P-I, 31μ (31μ-32μ); P-II, 66μ (62μ-66μ); P-III, 34μ (33μ-34μ); P-IV, 73μ (73μ-78μ); P-V, 37μ (35μ-37μ); structure of the palp similar to *borealis* but P-IV narrower and the ventral tubercle somewhat more projecting than in the specimens illustrated (fig. 10); dorsal lengths of the distal segments of the first leg: I-Leg-4, 75μ (74μ-75μ); I-Leg-5, 107μ (104μ-107μ); I-Leg-6, 131μ (131μ-135μ); leg segments similar to those of *borealis* but slightly thinner than in the example illustrated (fig. 5); several long swimming hairs present on third and fourth legs; II-Leg-4

usually with two or three swimming hairs which are nearly as long as the following segment.

Male: Dorsal shield 653μ (624μ-684μ) in length, 532μ (532μ-548μ) in width; structure and color pattern of the dorsum as in the female; ventral shield 707μ (699μ-760μ) in length, 593μ (593μ-608μ) in width; structure of venter as in *borealis* (fig. 4); dorsal lengths of the palpal segments: P-I, 24μ (24μ-28μ); P-II, 55μ (55μ-58μ); P-III, 31μ (31μ-32μ); P-IV, 66μ (66μ-69μ); P-V, 31μ (31μ-34μ); dorsal lengths of the distal segments of the first leg: I-Leg-4, 73μ (72μ-76μ); I-Leg-5, 97μ (97μ-103μ); I-Leg-6, 131μ (131μ-142μ); structure of palp and legs as described for the female.

Holotype: Adult ♀, collected in the South Branch of the Umpqua River near Milo, Douglas County, Oregon, August 11, 1961.

Allotype: Adult ♂, same data as holotype.

Paratypes: One ♂, same data as holotype; 1 ♂, 1 ♀, from the South Fork of the Trinity River near Forest Glen State Park, Trinity County, California, July 30, 1966; 2 ♂♂, from Moccasin Creek, Tuolumne County, California, October 26, 1970.

Discussion: Structure of the ventral shield, palpal and leg segments is similar to that of *borealis*. The new subspecies differs most noticeably in the pattern on the dorsal shield (fig. 87). This color pattern (primarily involving the area shown in broken lines on figure 1) is very different from anything exhibited by the eastern *borealis* and, even given the wide variation in dorsal color pattern found in the latter, is not easily derived from any known member of the typical subspecies.

3. Mideopsis (Mideopsis) jacunda, new species

(Figures 2, 3, 7, 93)

Male: Dorsal shield 912μ (912μ-957μ) in length, 798μ (798μ-821μ) in width; color pattern of the dorsum shown in figure 93; median semicircular raised area of dorsal shield very well developed; ventral shield 1003μ (1003μ-1034μ) in length, 897μ (897μ-912μ) in width; figure 7 shows the structure of the ventral shield; three pairs of genital acetabula; dorsal lengths of the palpal segments: P-I, 42μ (41μ-42μ); P-II, 81μ (79μ-81μ); P-III, 48μ (45μ-48μ); P-IV, 99μ (99μ-100μ); P-V, 48μ (45μ-48μ); setal tubercle on ventral side of P-IV relatively long; figure 2 illustrates the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 98μ (96μ-98μ); I-Leg-5, 137μ (137μ-141μ); I-Leg-6, 177μ (170μ-177μ); figure 3 shows these segments; several very long swimming hairs present on third and fourth legs; II-Leg-4 with two swimming hairs approximately as long as the fifth segment.

Female: Unknown.

Holotype: Adult ♂, from Little Creek near its junction with the West Fork of the Gila River, Catron County, New Mexico, October 21, 1970.

Paratype: One ♂, from Moccasin Creek on Highway 49 approximately six miles southeast of Highway 120, Tuolumne County, California, October 26, 1970.

Discussion: The new species seems to be related to *borealis* and in color pattern is closer to the western subspecies *californica* (compare figures 87, 83). The present species differs most noticeably in being much larger and in having a proportionally much longer setal tubercle on the ventral side of P-IV (fig. 2).

4. Mideopsis (Mideopsis) fibrosa Lundblad

(Figures 6, 8, 9, 92)

Mideopsis fibrosa Lundblad, 1941. Zool. Anz., 133: 159.
Mideopsis orbicularis neoorbicularis Habeeb, 1958. Leaflets Acadian Biol., 17: 2. (new synonymy)
Mideopsis neoorbicularis Habeeb, 1967. op. cit., 43: 7.

Female: Dorsal shield 866μ-1049μ in length, 714μ-821μ in width; the area indicated by the broken lines on the diagramatic dorsum drawing (fig. 1) pronounced; often (as in the holotype) the surface of the dorsal shield may have portions which appear fibrous (fig. 92); however, not all specimens exhibit this fibrous condition and may appear more as illustrated in the preceding species (fig. 93); anteromedian semicircular raised area may be pronounced but more commonly is poorly developed or actually absent; color of dorsum often somewhat bluish; ventral shield 942μ-1140μ in length, 806μ-942μ in width; gonopore 104μ-111μ in width; three pairs of genital acetabula; dorsal lengths of the palpal segments: P-I, 38μ-41μ; P-II, 72μ-78μ; P-III, 40μ-44μ; P-IV, 83μ-93μ; P-V, 42μ-47μ; setal tubercle on ventral side of P-IV short, not nearly as well developed as in the preceding species; figure 6 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 98μ-111μ; I-Leg-5, 133μ-148μ; I-Leg-6, 163μ-170μ; leg segments proportionally narrow (fig. 8); second, third and fourth legs with several long swimming hairs, first leg with a few shorter swimming hairs.

Male: Unknown.

Habitat and Distribution: This is a lake and permanent pond inhabiting species which was originally described by Lundblad (1941) from a specimen taken in Michigan. I have collected it in many areas of the Lower Peninsula of Michigan and have seen specimens from Ontario in the collections of the Royal Ontario Museum. Habeeb (1958) reported this species (*neoorbicularis*) from a pond in New Jersey.

Discussion: *M. fibrosa* seems most closely related to the preceding species, *M. jacunda*, both being very large members of the *orbicularis*-group with a somewhat similar structure of the dorsal shield (figs. 92, 93). *M. fibrosa* differs in having more swimming hairs (many on the second leg, a few on the first leg) which seems to be related to the habitat difference between the two. *M. fibrosa* is a "standing water" species, *jacunda* occurs in streams. *M. fibrosa* also differs in having a much shorter setal tubercle on the ventral side of P-IV. I have not been able to examine the material on which Habeeb's *M. neoorbicularis* was based and the latter author gave no illustrations. The original description is lacking in many critical details but all described characteristics, including habitat type, suggest it is conspecific with *fibrosa*.

5. Mideopsis (Mideopsis) americana Marshall

(Figures 14, 16, 18, 91)

Mideopsis americanus Marshall, 1940. Trans. Wisconsin Acad. Sci., 32: 140.
Mideopsis rosea Lundblad, 1941. Zool. Anz., 133: 159. (new synonymy).

Female: Dorsal shield 570μ-775μ in length, 502μ-646μ in width; dorsal shield somewhat variable but typically with the three color patches present (fig. 91); in some specimens the lateral pair of pigment areas often more

extensive than illustrated and in others there may be a lightening of the pigment until it almost disappears; the anterolateral pair of curved ridges shown in figure 1 are usually prominent but the median ridge or raised area is absent; the areas surrounding the posterior muscle scars usually also very prominent; ventral shield 638μ-821μ in length, 562μ-714μ in width; figure 14 shows the structure of the venter; gonopore 81μ-99μ in width; three pairs of genital acetabula; capitular bay tending to be V-shaped; dorsal lengths of the palpal segments: P-I, 27μ-33μ; P-II, 54μ-62μ; P-III, 31μ-35μ; P-IV, 73μ-95μ; P-V, 23μ-34μ; dorsal side of P-IV decidedly bowed in the distal one-half and cuticle of this side very thick; setal tubercle on ventral side of P-IV varying from poorly developed (fig. 16) to moderately developed (subfigure immediately below tubercle in figure 16); cuticle having a double layered appearance ventrally on P-IV distal to the setal tubercle; both ventral setae on P-IV moderately long; dorsal lengths of the distal segments of the first leg: I-Leg-4, 65μ-83μ; I-Leg-5, 83μ-110μ; I-Leg-6, 104μ-134μ; ventral side of I-Leg-4 with a very long thickened seta (fig. 18, arrow); third and fourth legs with many swimming hairs which are much longer than the following segment; second leg with a few swimming hairs approximately the same length as the following segment.

Male: Dorsal shield 502μ-684μ in length, 456μ-592μ in width; color pattern and structure of dorsal shield as described and illustrated for the female; ventral shield 578μ-753μ in length, 517μ-668μ in width; except in structure of genital field region, venter similar to that illustrated for the female; dorsal lengths of the palpal segments: P-I, 27μ-29μ; P-II, 48μ-58μ; P-III, 29μ-31μ; P-IV, 69μ-83μ; P-V, 22μ-31μ; dorsal lengths of the distal segments of the first leg: I-Leg-4, 62μ-79μ; I-Leg-5, 83μ-109μ; I-Leg-6, 107μ-131μ; structure of palp and legs as described and illustrated for the female.

Habitat and Distribution: This is primarily a pond and lake dwelling species but I have seen specimens in the collections of the Royal Ontario Museum which were taken in a River (Indian River at Warsaw Caves, Peterborough County, Ontario). Marshall (1940) listed this species from Wisconsin, Illinois, Iowa, Michigan, Indiana, Montana and British Columbia and Conroy (1968) records it from Manitoba, Saskatchewan and British Columbia. In addition, I have taken specimens in Minnesota, California and Washington, and there are individuals from New York and Alberta in the collections of the Royal Ontario Museum.

Discussion: The present species is a member of a species subgroup (which also includes the following three species, *olseni*, *lamellipalpis*, *marshallae*, characterized by the double layered condition of the cuticle immediately distal to the setal tubercle of P-IV. *M. americana* also appears to be an extremely variable species in size, proportional thickness of the appendages, color pattern of the dorsum and habitat type. The color pattern tends to be relatively constant within a population but there can be a wide variation in size and segment proportions. As in the case of *M. borealis*, it is possible that this is actually a species complex. If so, information other than adult structure will be needed to separate the species. For the present all *orbicularis*-group specimens with the strongly bowed P-IV (fig. 16) are placed in *americana*. *M. rosea* Lundblad seems to be identical with *americana*. Lundblad's publication appeared approximately one year after Marshall's paper and this is likely a case of almost simultaneous publication, rather than Lundblad's intent that *rosea* was a species distinct from *americana*. Prasad and Cook (1972) describe the larva of the present species.

6. Mideopsis (Mideopsis) olseni, new species

(Figures 17, 19, 21, 94)

Female: Dorsal shield 882μ (760μ-882μ) in length, 729μ (623μ-729μ) in width; color pattern typically consisting of the two lateral color patches (fig. 94) which are a light blue but these may be so faint as to nearly disappear; the anterolateral pair of curved ridges shown in figure 1 are usually well developed but the anteromedial ridge is absent; ventral shield 927μ (806μ-927μ) in length, 790μ (729μ-790μ) in width; figure 17 shows the morphology of the ventral shield; gonopore 111μ (104μ-113μ) in width; three pairs of genital acetabula; capitular bay tending to be U-shaped; dorsal lengths of the palpal segments: P-I, 35μ (31μ-35μ); P-II, 72μ (67μ-72μ); P-III, 43μ (38μ-43μ); P-IV, 97μ (90μ-97μ); P-V, 35μ (31μ-35μ); dorsal side of P-IV only slightly bowed; cuticle on dorsal side of P-IV thick, setal tubercle on ventral side of this segment moderately developed and the more proximal of the associated setae somewhat larger than the distal seta (fig. 21); cuticle having a double layered appearance distal to the setal tubercle of P-IV; dorsal lengths of the distal segments of the first leg: I-Leg-4, 86μ (79μ-86μ); I-Leg-5, 114μ (100μ-114μ); I-Leg-6, 124μ (117μ-124μ); ventral side of I-Leg-4 with either a very short thickened seta (fig. 19, arrow) or more commonly none in this position; third and fourth legs with several swimming hairs which are much longer than the following segment; second leg with a few swimming hairs which are noticeably longer than the following segment.

Male: Dorsal shield 684μ (644μ-684μ) in length, 540μ (532μ-577μ) in width; structure and color pattern of dorsum as described and illustrated for the female; ventral shield 745μ (722μ-752μ) in length, 646μ (623μ-684μ) in width; venter similar to female except in morphology of the genital field region; dorsal lengths of the palpal segments: P-I, 30μ (28μ-33μ); P-II, 71μ (62μ-71μ); P-III, 45μ (42μ-45μ); P-IV, 95μ (95μ-100μ); P-V, 30μ (28μ-30μ); dorsal lengths of the distal segments of the first leg: I-Leg-4, 86μ (83μ-87μ); I-Leg-5, 111μ (104μ-111μ); I-Leg-6, 135μ (131μ-138μ); structure of palp and legs as illustrated and described for the male.

Holotype: Adult ♀, collected in the Michigan Pumped Storage Hydroelectric Reservoir, Ludington, Mason County, Michigan, October 17, 1973 (leg. Gregory R. Olsen).

Allotype: Adult ♂, same data as holotype.

Paratypes: Four ♂♂, 8 ♀♀, same data as holotype.

Discussion: The present species is closely related to *M. americana* but differs in a number of tendencies as well as one absolute difference. *M. olseni* tends to be larger, has a less bowed P-IV (compare figures 16, 21) and has a U-shaped (rather than V-shaped) capitular bay. It appears that the color patterns are different (compare figures 91, 94) but, in view of the variability of dorsal color patterns in many members of the *orbicularis*-group, this difference may not hold up when other populations of the present species are known. The one absolute difference is that *americana* has a long thickened seta on the ventral side of I-Leg-4 (fig. 18, arrow). In *olseni*, the homologous seta is usually absent but, if present, is very short (fig. 19, arrow).

7. Mideopsis (Mideopsis) lamellipalpis Lundblad

(Figures 20, 24, 27, 88, 89)

Mideopsis lamellipalpis Lundblad, 1941. Zool. Anz., 133: 159.

Female: Dorsal shield 544μ-608μ in length, 471μ-540μ in width; color pattern of dorsum consisting of the two lateral patches, with little development of the anteromedial patch (figs. 88, 89); the anterolateral pair of curved ridges prominent but the anteromedial ridge is absent; ventral shield 620μ-662μ in length, 562μ-608μ in width; except in structure of the genital field region, ventral shield similar to that shown for the male; gonopore 71μ-78μ in width; three pairs of genital acetabula; capitular bay tending to be V-shaped; dorsal lengths of the palpal segments: P-I, 20μ-24μ; P-II, 46μ-52μ; P-III, 27-31μ; P-IV, 73μ-81μ; P-V, 26μ-30μ; dorsal lengths of the distal segments of the first leg: I-Leg-4, 55μ-62μ; I-Leg-5, 72μ-79μ; I-Leg-6, 92μ-94μ; structure of palp and legs similar to that described and illustrated for the male.

Male: Dorsal shield 471μ-532μ in length, 426μ-456μ in width; color and morphology of dorsum as described and illustrated for the female; ventral shield 536μ-608μ in length, 494μ-532μ in width; figure 20 illustrates the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I, 19μ-21μ; P-II, 45μ-48μ; P-III, 24μ-26μ; P-IV, 72μ-74μ; P-V, 24μ-27μ; dorsal side of P-IV somewhat bowed in proximal portion, cuticle greatly thickened dorsally and ventrally on this segment; setal tubercle on ventral side of P-IV short and bearing two small unthickened setae (fig. 24); cuticle having a two-layered appearance ventrally on P-IV distal to the setal tubercle; dorsal lengths of the distal segments of the first leg: I-Leg-4, 52μ-59μ; I-Leg-5, 66μ-78μ; I-Leg-6, 90μ-104μ; figure 27 illustrates these segments; third and fourth legs with several swimming hairs which are much longer than the following segment; second leg with two or three swimming hairs approximately same length as the following segment.

Habitat and Distribution: This species seems primarily to be an inhabitant of lakes and permanent ponds, but I have collected a specimen from a stream in the Ozark area which appears to be conspecific. Lundblad (1941) based this species on a specimen collected in Wisconsin. I have taken it in several Michigan lakes and from the Current River, Shannon County, Missouri. I have seen specimens in the collections of the Royal Ontario Museum which were taken from lakes in Ontario and Quebec.

Discussion: The structure of the palp, with its double layered cuticle distal to the setal tubercle of P-IV, indicates the affinities of the present species with *americana*. However, there are a number of important differences in the palp which distinguish the two. In *lamellipalpis*, the palpal segments, especially P-II, are proportionally much shorter and stockier and the dorsal bowing of P-IV is proximal in position in the present species. Also, the setal tubercle and associated setae of P-IV are much smaller and the leg segments are proportionally (and usually absolutely) shorter in *lamellipalpis*. The specimen from Missouri has a much deeper color pattern (fig. 89) than those from the lakes (fig. 88), although other specimens from the latter habitat may be darker than the one illustrated. The specimen from Missouri was taken in one of the swift Ozark streams which is in strong contrast to the lake habitat of the northern populations. It is difficult for me to accept the two as being conspecific but, in view of the lack of structural differences and considering the habitat and color differences shown by other members of the *orbicularis*-group, they are here considered members of the same species.

8. Mideopsis (Mideopsis) marshallae, new species

(Figures 22, 23, 26, 90)

Female: Dorsal shield 669μ (616μ-714μ) in length, 578μ (543μ-608μ) in width; color pattern typically consisting of the three color patches shown in the diagramatic drawing of the dorsum (fig. 1); figure 90 shows a specimen with deep pigmentation, some of the other individuals have much lighter color patches; anterolateral pair of curved ridges usually well developed but anteromedial ridge absent; ventral shield 760μ (684μ-790μ) in length, 673μ (616μ-673μ) in width; figure 23 illustrates the morphology of the ventral sheild; gonopore 98μ (93μ-98μ) in width; three pairs of gential acetabula; dorsal lengths of the palpal segments: P-I, 27μ (23μ-29μ); P-II, 66μ (56μ-66μ); P-III, 35μ (31μ-35μ); P-IV, 95μ (91μ-105μ); P-V, 31μ (31μ-37μ); P-IV relatively long and dorsal side only slightly bowed; cuticle of this segment only moderately thickened; setal tubercle on ventral side of P-IV only very slightly developed and the associated setae very small (fig. 22); cuticle having a double layered appearance distal to the setal tubercle of P-IV; dorsal lengths of the distal segments of the first leg: I-Leg-4, 69μ (67μ-76μ); I-Leg-5, 97μ (89μ-103μ); I-Leg-6, 111μ (111μ-121μ); figure 26 shows these segments; third and fourth legs with several swimming hairs which are longer than the following segment; second leg with two or three swimming hairs which are approximately the same length as the following segment.

Male: Dorsal shield 623μ in length, 532μ in width; structure and color pattern of dorsal shield as in the female; ventral shield 714μ in length, 623μ in width; male ventral shield similar to female except in genital field region; dorsal lengths of the palpal segments: P-I, 25μ; P-II, 55μ; P-III, 33μ; P-IV, 97μ; P-V, 31μ; dorsal lengths of the distal segments of the first leg: I-Leg-4, 71μ; I-Leg-5, 104μ; I-Leg-6, 128μ; structure of palp and legs as described and illustrated for the female.

Holotype: Adult ♀, collected in Head Lake, Barry County, Michigan, July 12, 1967.

Allotype: Adult ♂, from Lake Katchiwano near Lakefield, Peterborough County, Ontario, August 14, 1969 (collection of the Royal Ontario Museum).

Paratypes: Three ♀♀, same data as holotype; 1 ♀, from Munro Lake, Cheboygan County, Michigan, July 18, 1951; 1 ♀, same area as previous collection on August 15, 1951; 3 ♀♀, from Ocqueoc Lake, Presque Isle County, Michigan, July 25, 1951; 1 ♀, from North Twin Lake, Mahnomen County, Minnesota, July 8, 1969; 1 ♀, from Lake Opinicon (Chaffey's Locks), Leeds County, Ontario, July 29, 1972; 1 ♂, taken in Meach Lake, Gatineau Park, Quebec, June 23, 1971; 1 ♀, found in Lac Philippe, Gatineau Park near Ottawa, August 16, 1971 (these last three collections from the Royal Ontario Museum).

Discussion: The structure of the palp with its double layered cuticle anterior to the setal tubercle of P-IV indicates the relationship of the new species with *americana*, *olseni* and *lamellipalpis*, and it appears to be most similar to the latter. *M. marshallae* differs most noticeably in its proportionally very long P-IV and the lack of setal tubercle development on this segment.

9. Mideopsis (Mideopsis) gladiator Habeeb

(Figures 11-13, 15, 95)

Mediopsis gladiator Habeeb, 1962. Leaflets Acadian Biol., 25: 1.

Female: Dorsal shield 714μ in length, 631μ in width; dorsal shield with a central raised area which terminates in a point (similar but not as high as shown for the male, figure 13); figure 95 illustrates the typical color pattern of the dorsal shield; ventral shield 790μ in length, 722μ in width; gonopore 89μ in width; three pairs of genital acetabula; genital field area distinctly raised and bearing a few setae; first two pairs of coxae ending in well developed, recurved hook-like processes (fig. 11); dorsal lengths of the palpal segments: P-I, 31μ; P-II, 62μ; P-III, 35μ; P-IV, 73μ; P-V, 37μ; setal tubercle on ventral side of P-IV only moderately developed (fig. 15); dorsal lengths of the distal segments of the first leg: I-Leg-4, 80μ; I-Leg-5, 111μ; I-Leg-6, 131μ; third and fourth legs with several swimming hairs, II-Leg-4 and 5 typically with two swimming hairs each.

Male: Dorsal shield 566μ in length, 502μ in width; dorsal shield as described for the female but the central raised area somewhat higher; ventral shield 631μ in length, 566μ in width; except for the genital field area, structure of venter as illustrated and described for the female; figure 13 shows a lateral view of the body; genital field area projecting more than in the female (best seen in lateral view) and its outer edges provided with many more setae (fig. 12); gonopore 103μ in length; three pairs of genital acetabula; dorsal lengths of the palpal segments: P-I, 29μ; P-II, 55μ; P-III, 31μ; P-IV, 62μ; P-V, 33μ; dorsal lengths of the distal segments of the first leg: I-Leg-4, 66μ; I-Leg-5, 93μ; I-Leg-6, 117μ; palp and legs as in the female.

Habitat and Distribution: This is a stream inhabiting species originally described from specimens taken in Dutch Hollow Brook near Owasco, Cayuga County, New York. I have not collected this species but have seen material in the Royal Ontario Museum which was found in the Indian River at Warsaw Caves, Peterborough County, Ontario.

Discussion: The hook-like endings of the first two pairs of coxae are unique among the Mideopsidae. Other than this character, and the somewhat more protruding genital field and projection on dorsal shield, it seems rather similar to members of the *orbicularis*-group.

10. Mideopsis (Mideopsis) crassipes Soar

(Figures 23, 29, 30, 32, 97, 98, 100)

Mideopsis crassipes Soar, 1904. J. Quekett Microsc. Club (s. 2), 9: 107. (See Viets, 1956 for additional synonymy. This species had previously been reported only from the Palearctic region.)

Female: (Given in parentheses are the measurements of a single specimen from New Mexico which differs in being much larger than the eastern populations and the single specimen from California); dorsal shield 729μ-821μ (927μ) in length, 578μ-684μ (798μ) in width; dorsal shield oval but decidedly narrower at anterior end; ridges on dorsal shield usually well developed; figure 97 shows the typical color pattern of the dorsum, but I have one specimen from southern Michigan (fig. 98) in which the dorsum is almost entirely dark; ventral shield 760μ-882μ (973μ) in length, 730μ-805μ (926μ) in width; ventral shield oval,

capitular bay U-shaped; median margins of fourth coxae reduced; epimeroglandularia 2 lying slightly anterolateral to the genital field in a small indentation on each side; a ridge present on each side extending anterolaterally from the area of insertion of the fourth legs; continuation of these ridges posterior to the fourth legs varying from short to rather long; gonopore 100μ-111μ (115μ) in width; gonopore flanked by a pair of setae-bearing sclerites; width between outer margins of these sclerites 152μ-163μ (177μ); figure 29 illustrates the genital field region; dorsal lengths of the palpal segments: P-I, 31μ-36μ (38μ); P-II, 62μ-69μ (90μ); P-III, 35μ-38μ (46μ); P-IV, 83μ-93μ (117μ); P-V, 34μ-38μ (43μ); ventral tubercle on P-IV long and directed nearly distally (fig. 30); dorsal lengths of the distal segments of the first leg: I-Leg-4, 76μ-83μ (117μ); I-Leg-5, 93μ-104μ (138μ); I-Leg-6, 125μ-136μ (162μ); figure 32 illustrates these segments; there is considerable variation in stockiness of the leg segments, even within a single population; third and fourth legs with swimming hairs.

Male: Dorsal shield 662μ-699μ in length, 532μ-586μ in width; dorsal shield as described for the female; ventral shield 707μ-730μ in length, 638μ-669μ in width; except for the genital field area, ventral shield as described for the female (fig. 25); gonopore 155μ-162μ in length; three pairs of genital acetabula; epimeroglandularia 2 located in a line with the anterior end of the genital field; dorsal lengths of the palpal segments: P-I, 29μ-31μ; P-II, 60μ-64μ; P-III, 35μ-38μ; P-IV, 76μ-80μ; P-V, 34μ-35μ; dorsal lengths of the distal segments of the first leg: I-Leg-4, 83μ-86μ; I-Leg-5, 97μ-100μ; I-Leg-6, 137μ-139μ; structure of palp and legs as described and illustrated for the female.

Habitat and Distribution: This species was originally described from the Palearctic region and has a widespread distribution in Europe. It is also known from eastern Siberia. In the Old World it has been collected in both lakes and streams but in North America only from the latter habitat type. I have collected specimens from the following localities: Creek formed by the Yankee Springs, Barry County, Michigan (T3N/R10W/S26), September 25, 1959; Duck Creek approximately one mile south of Watersmeet, Gogebic County, Michigan, August 14, 1960; small stream flowing into St. Froid Lake, Aroostook County, Maine, September 3, 1968; Jardine Brook approximately 10 miles southwest of St. Quentin, Victoria County, New Brunswick, August 27, 1964; creek beside Highway 11, three miles south of Trout Creek, Nipissing District, Ontario on May 14, June 1, September 29, 1972 (collections of the Royal Ontario Museum); small stream on Routes 11 and 64, two miles east of Ft. Frances, Rainy River District, Ontario, June 11, 1971 (collections of the Royal Ontario Museum); Moccasin Creek, Tuolumne County, California, July 24, 1966; one female (the specimen whose measurements are given in parentheses), Little Creek on Route 15 near Gila Cliff Dwellings National Monument, Catron County, New Mexico, October 21, 1970.

Discussion: It is not certain that the New World and Old World populations are conspecific. However, European *crassipes* exhibits a great deal of variation in the proportions of the appendage segments and I cannot find any consistent differences between the two. The two specimens from western North America have the dorsal shield proportionally somewhat wider than is typical of the eastern populations (compare figure 100 with figures 97, 98). The specimen from California falls within the range of size variation found in the eastern populations, but the mite from New Mexico is much larger and P-IV is proportionally much longer. This suggests the latter may belong to a separate species or subspecies, but additional specimens will be needed before any definite conclusion can be made.

Members of the *crassipes*-group are unique among the Mideopsidae in that the female gonopore is flanked by a pair of setae-bearing sclerites which are separated from the remainder of the ventral shield (fig. 29). Following are the descriptions of two additional members of this species group.

11. Mideopsis (Mideopsis) laversi, new species

(Figure 99)

Female: Dorsal shield 897μ (790μ-897μ) in length, 798μ (684μ-798μ) in width; ridges on dorsal shield varying from well developed to poorly developed to completely absent; dorsal shield usually almost rounded or at least not narrower at anterior end than at posterior end; pigmentation greatly reduced (fig. 99); ventral shield 988μ (866μ-988μ) in length, 896μ (790μ-896μ) in width; ventral shield oval, its structure similar to that shown for *M. crassipes* (fig. 23); gonopore 111μ (104μ-118μ) in width; gonopore flanked by a pair of setae-bearing sclerites; width between outer margins of these sclerites 170μ (159μ-185μ); three pairs of genital acetabula; structure of genital field as shown for the related species (fig. 29); dorsal lengths of the palpal segments: P-I, 41μ (38μ-41μ); P-II, 83μ (73μ-83μ); P-III, 45μ (41μ-45μ); P-IV, 104μ (97μ-104μ); P-V, 38μ (35μ-39μ); ventral tubercle on P-IV long and directed distally; structure of palp similar to that shown in figure 30; dorsal lengths of the distal segments of the first leg: I-Leg-4, 100μ (87μ-104μ); I-Leg-5, 121μ (104μ-128μ); I-Leg-6, 149μ (128μ-162μ); leg segments variable in degree of stockiness as in crassipes; third and fourth legs with swimming hairs.

Male: Dorsal shield 836μ (821μ-836μ) in length, 790μ (775μ-790μ) in width; dorsal shield as in the female; ventral shield 942μ (942μ-957μ) in length, 866μ in width; structure of the ventral shield similar to that shown for *crassipes* (fig. 23) but with a somewhat more rounded outline; gonopore 170μ (170μ-178μ) in length; three pairs of genital acetabula; dorsal lengths of the palpal segments: P-I, 41μ (39μ-41μ); P-II, 78μ (78μ-80μ); P-III, 44μ (44μ-45μ); P-IV, 104μ (104μ-106μ); P-V, 37μ (37μ-38μ); structure of palp similar to that of *crassipes* (fig. 30); dorsal lengths of the distal segments of the first leg: I-Leg-4, 111μ (108μ-111μ); I-Leg-5, 124μ (124μ-128μ); I-Leg-6, 162μ (162μ-166μ); third and fourth legs with swimming hairs.

Holotype: Adult ♀, from bottom gravels in Wages Creek on Highway 1, approximately one mile north of Westport, Mendocino County, California, October 28, 1970.

Allotype: Adult ♂, same data as the holotype.

Paratypes: One ♂, same data as the holotype; 2 ♀♀, from bottom gravels in the South Fork of the Trinity River, Trinity County, California, July 30, 1966; 1 ♀ from the same area on October 27, 1970; 1 ♀, from bottom gravels in Ten Mile Creek south of Yachats, Lane County, Oregon, August 4, 1966.

Discussion: Unfortunately, only a few specimens belonging to the *crassipes*-species group have been collected in the western portion of the United States and we do not have a clear picture of the types of variation to be expected. However, the specimens here described as *laversi* seem distinct enough to deserve species ranking. The new species differs most noticeably in its rounded dorsal shield with the anterior end no more narrowed than the posterior end, and the reduction in integumental pigmentation. *M. laversi* also seems to have a distinctive distribution, being presently known from coastal streams at lower elevations in Northern California and Southern Oregon. The ridges of the dorsal shield

which are "typical" of the *crassipes*-group vary from prominent (fig. 99) to absent, even within the same population.

12. Mideopsis (Mideopsis) barri, new species

(Figures 28, 31, 96)

Female: Dorsal shield 798μ in length, 616μ in width; lateral ridges of dorsal shield slightly developed and confined to the anterior two-thirds; no color pattern on the dorsum (fig. 96); ventral shield 821μ in length, 729μ in width; ventral shield oval, edges smooth; capitular bay a rounded V-shape; median margins of fourth coxae reduced; epimeroglandularia 2 lying at the edge of the fourth coxae well anterior to the genital field; a ridge present on each side extending anteriorly from the area of insertion of the fourth legs; continuation of these ridges posterior to the fourth legs very short; gonopore 103μ in width; gonopore flanked by a pair of setae-bearing sclerites, width between outer margins of these sclerites 177μ; three pairs of genital acetabula; dorsal lengths of the palpal segments: P-I, 33μ; P-II, 69μ; P-III, 46μ; P-IV, 116μ; P-V, 34μ; ventral tubercle on P-IV extremely long and directed distoventrally; figure 31 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 104μ; I-Leg-5, 110μ; I-Leg-6, 142μ; fourth legs with a single short swimming hair on segments 4 and 5.

Male: Unknown.

Holotype: Adult ♀, collected in mosses on a rock in the Gibbon River above Virginia Cascades, Yellowstone National Park, Wyoming (temperature 10° C.), September 1, 1961.

Discussion: The structure of the female genital field, with its separated setae-bearing sclerites flanking the gonopore places the present species in the *crassipes* group. It differs most noticeably from other members of the group in its narrower body, more ventrally directed tubercle on the ventral side of P-IV (compare figures 30 and 31) and the reduction in size and number of swimming hairs on the legs.

13. Mideopsis (Neoxystonotus) reelfootensis (Hoff)

(Figures 33-39, 101, 102)

Xystonotus reelfootensis Hoff, 1944. Jour. Tenn. Acad. Sci., 19: 234.

Male: Dorsal shield 471μ-502μ in length, 395μ-456μ in width; dorsal shield with a low central ridge flanked by a deep concavity on each side, the structure of which is better shown (fig. 102) than described; the area lateral to the concavities with a variable number of smaller longitudinal ridges (best indicated in the female dorsum, figure 101); three pairs of large glandularia grouped in a triangle on each side close to the posterior end; ventral shield 540μ-577μ in length, 532μ-608μ in width; dorsal rim of ventral shield (area joining the dorsal shield) very wide; posterolateral corners of ventral shield variable, most specimens with glandularia tubercles as shown in figure 34 but tubercles vary in size and I have a single specimen (fig. 39) in which these structures are for all purposes absent; median margins of fourth coxae reduced to median angles and separated by the genital field; epimeroglandularia 2 located somewhat anterolateral to the genital field; a ridge present on each side extending anteriorly from the region of insertion of the fourth legs; gonopore 63μ-77μ in length;

three pairs of genital acetabula; excretory pore flanked by two pairs of glandularia; dorsal lengths of the palpal segments: P-I, 28μ-34μ; P-II, 54μ-56μ; P-III, 33μ-37μ; P-IV, 61μ-66μ; P-V, 22μ-25μ; setae of palp short and reduced in number; figure 36 shows the proportions and chaetotaxy of the palp; dorsal lengths of the segments of the fourth leg: IV-Leg-1, 136μ-142μ; IV-Leg-2, 126μ-148μ; IV-Leg-3, 93μ-116μ; IV-Leg-4, 89μ-103μ; IV-Leg-5, 207μ-222μ; IV-Leg-6, 159μ-170μ; figures 33 and 37 illustrate the proportions and chaetotaxy of the fourth leg; third and fourth legs with well developed swimming hairs.

Female: Dorsal shield 593μ-684μ in length, 517μ-577μ in width; dorsal shield with a central ridge flanked by a narrow concavity on each side (fig. 101); a variable number of smaller longitudinal ridges present lateral to the concavities; ventral shield 669μ-758μ in length, 653μ-699μ in width; dorsal rim of ventral shield very wide; median margins of fourth coxae reduced to median angles; epimeroglandularia 2 located well anterolateral to the genital field; gonopore 100μ-106μ in width; three pairs of genital acetabula, these relatively wide; excretory pore flanked by two pairs of glandularia; figure 38 illustrates the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, 33μ-35μ; P-II, 52μ-59μ; P-III, 35μ-38μ; P-IV, 62μ-67μ; P-V, 23μ-24μ; figure 35 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 83μ-90μ; I-Leg-5, 104μ-114μ; I-Leg-6, 114μ-121μ; third and fourth legs with well developed swimming hairs.

Habitat and Distribution: This is a lake and permanent pond inhabiting species which was originally described from Reelfoot Lake in extreme northeastern Tennessee. I have found it to be a common species in most parts of Florida.

Discussion: When one looks at the extremes of variation of tubercle development at the posterior end of the male ventral shield (figs. 34, 39), it is difficult to believe they are not separate species. However, I have specimens exhibiting all degrees of development between these two extremes. The specimen with the greatest reduction of the tubercles (fig. 39) also has the segments of the fourth leg somewhat more stocky (fig. 37) than is typical of the species (fig. 33), but again there is gradation between these two extremes.

14. Mideopsis (Xystonotus) aspera (Wolcott)

(Figures 41-43, 48, 103, 104)

Xyxtonotus asper Wolcott, 1900. Trans. Amer. Microsc. Soc., 21: 186.

Female: Dorsal shield 517μ-577μ in length, 418μ-486μ in width; dorsal shield with a pair of conspicuous lateral ridges which converge posteriorly in a somewhat rounded V-shape (fig. 103); color pattern of the dorsum destroyed on the cotype slides but specimens from Ontario exhibit right and left color patches (fig. 104); ventral shield 478μ-653μ in length, 510μ-578μ in width; dorsal rim of ventral shield (area joining the dorsal shield) relatively wide (up to 37μ laterally); edges of ventral shield relatively smooth; color noticeably deeper in coxal suture lines; capitular bay a rounded V-shape; median suture lines of fourth coxae very short or actually reduced to a median angle (fig. 42); a ridge present on each side extending anterolaterally from the region of insertion of the fourth legs; genital bay shallow, containing less than one-half length of the genital field; gonopore 85μ-89μ in width; three pairs of genital acetabula; epimeroglandularia 2 located opposite the first pair of acetabula; dorsal lengths of the palpal segments: P-I, 27μ-30μ; P-II, 52μ-55μ; P-III, 36μ-38μ; P-IV, 58μ-62μ; P-V, 26μ-28μ; P-IV relatively high at proximal end; figure 43

illustrates the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 62μ-69μ; I-Leg-5, 72μ-83μ; I-Leg-6, 83μ-86μ; figure 41 illustrates these segments; all legs stocky and without swimming hairs.

Male: Dorsal shield 471μ in length, 388μ in width; dorsal shield as described for the female; ventral shield 540μ in length, 471μ in width; except for genital field region, ventral shield as described and illustrated for the female; gonopore (slightly foreshortened) 103μ in length; three pairs of genital acetabula; epimeroglandularia 2 located opposite anterior end of second pair of acetabula; dorsal lengths of the palpal segments: P-I, 26μ; P-II, 46μ; P-III, 29μ; P-IV, 52μ; P-V, 24μ; palp similar to that of female; dorsal lengths of the distal segments of the first leg: I-Leg-4, 62μ; I-Leg-5, 69μ; I-Leg-6, 90μ; legs as in the female.

Habitat and Distribution: This is a lake inhabiting species which was originally described from two females collected in Lake St. Clair, Michigan in August, 1893. No additional specimens have been taken in Michigan, but specimens of both sexes were taken in Ontario (Chaffey's Locks, Lake Opinicon, Leeds County, Ontario (2 males, 2 females, June 27-30, 1972, 1 female, July 27, 1972). These latter specimens are from the collections of the Royal Ontario Museum.

Discussion: *M. aspera* and the following three species belong to a species group characterized by very pronounced ridges located comparatively far laterally on the dorsal shield (figs. 103-107). Do not confuse these with the less pronounced, more medially placed (often pore free) areas common to other members of the subgenus (figs. 108-114). *M. aspera* differs from other members of its group in being somewhat larger, having a smoother lateral edge of the ventral shield, a wider dorsal rim of the ventral shield, a proportionally longer P-II and a different habitat type. The other three species are stream (or interstitial) inhabitants. Also, as far as is known, the color pattern is slightly different in that these pigment centers are separated into right and left portions (fig. 104) in *aspera*, but joined posteromedially (fig. 105) in the others.

15. Mideopsis (Xystonotus) delicata (Habeeb)

(Figures 40, 44, 46, 47, 105)

Xystonotus delicatus Habeeb, 1954. Leaflets Acadian Biol., 4: 6.

Female: Dorsal shield 456μ-502μ in length, 364μ-406μ in width; dorsal shield with a pair of conspicuous lateral ridges which converge posteriorly in a somewhat rounded V-shape (fig. 105); color pattern consisting of right and left patches which fuse medially in the posterior portion of the dorsal shield; ventral shield 502μ-562μ in length, 410μ-441μ in width; dorsal rim of ventral shield relatively narrow (only up to 20μ in width laterally); edges of ventral shield tending to be somewhat irregular (fig. 40); color noticeably deeper on the fourth coxae and in the coxal suture lines; capitular bay a rounded V-shape; median suture lines of fourth coxae short; a ridge present on each side extending anterolaterally from the area of insertion of the fourth legs; genital bay shallow, containing considerably less than one-half the genital field; gonopore 66μ-80μ in width; three pairs of genital acetabula; epimeroglandularia 2 located opposite the second pair of acetabula; dorsal lengths of the palpal segments: P-I, 22μ-24μ; P-II, 34μ-38μ; P-III, 26μ-28μ; P-IV, 48μ-54μ; P-V, 20μ-21μ; P-II

proportionally rather short; figure 44 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 55μ-62μ; I-Leg-5, 66μ-72μ; I-Leg-6, 85μ-92μ; figure 47μ shows these segments; legs stocky and without swimming hairs.

Male: Dorsal shield 395μ-433μ in length, 312μ-338μ in width; dorsal shield as described for the female; ventral shield 449μ-471μ in length, 365μ-380μ in width; except for genital field region, ventral shield as described for the female; gonopore (somewhat foreshortened) 74μ-81μ in length; three pairs of genital acetabula; epimeroglandularia 2 located in a line with the posterior end of the first or anterior end of the second acetabula; dorsal lengths of the palpal segments: P-I, 26μ-27μ; P-II, 34μ-36μ; P-III, 24μ-26μ; P-IV, 47μ-49μ; P-V, 20μ-21μ; structure of palp as in female; dorsal lengths of the distal segments of the first leg: I-Leg-4, 61μ-63μ; I-Leg-5, 66μ-69μ; I-Leg-6, 88μ-90μ; legs as in female.

Habitat and Distribution: This species is an inhabitant of cold brooks and rivers and was originally described from streams in the vicinity of Grand Falls, New Brunswick. I have taken this species in streams near the type locality (headwaters of the Grand River on Route 17, and Jardine Brook -- both in Victoria County, New Brunswick, September 3, 1968). The temperature in these two streams was 11° C. I have also taken it in the following localities: Middlebury River, Addison County, Vermont, August 31, 1968 (temperature 15° C.); Miner River above Miner's Falls, Alger County, Michigan, August 27, 1959 (temperature 15° C.); headwaters of the Cranberry River on County Road 219, Ontonagon County, Michigan (T50N/R41W/S29), July 3, 1969 (temperature 13° C.).

Discussion: The paired ridges present on the dorsal shield place this species in the *aspera* group. See the discussion section under *aspera* for characters which will separate it from *delicata*. The present species seems most closely related to the following, *M. interstitialis*, but differs in being larger, having a more deeply pigmented color pattern and a different habitat type. The present species is also related to *M. vicina* but can be most easily distinguished by differences in the posterior end of the female ventral shield (compare figures 40, 54).

16. Mideopsis (Xystonotus) interstitialis, new species

(Figures 45, 49-51, 107)

Female: Dorsal shield 395μ (395μ-458μ) in length, 304μ (289μ-334μ) in width; dorsal shield with a pair of conspicuous lateral ridges which converge posteriorly into a somewhat rounded V-shape; color pattern consisting of right and left patches which fuse medially in the posterior portion of the dorsal shield; this color pattern tending to be very light (fig. 107); ventral shield 434μ (421μ-486μ) in length, 338μ (334μ-395μ) in width; dorsal rim of ventral shield relatively narrow (up to 18μ in width laterally); edges of ventral shield tending to be smooth (fig. 45); venter without a color pattern; capitular bay a rounded V-shape; median suture lines of fourth coxae short; a ridge present on each side extending anterolaterally from the region of insertion of the fourth legs; genital bay shallow, most of genital field not lying in the genital bay; gonopore 63μ (59μ-63μ) in width; three pairs of genital acetabula; dorsal lengths of the palpal segments: P-I, 23μ (22μ-24μ); P-II, 37μ (35μ-40μ); P-III, 22μ (22μ-26μ); P-IV, 50μ (45μ-52μ); P-V, 21μ (21μ-22μ); figure 50 illustrates the proportions and

chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 54μ (54μ-58μ); I-Leg-5, 69μ (66μ-73μ); I-Leg-6, 83μ (83μ-87μ); figure 49 shows the proportions and chaetotaxy of these segments: legs stocky, swimming hairs absent.

Male: Dorsal shield 350μ (327μ-350μ) in length, 258μ (254μ-274μ) in width; dorsal shield as described for the female; ventral shield 388μ (364μ-399μ) in length, 297μ (293μ-308μ) in width; except for genital field area, structure of ventral shield as in the female; gonopore (somewhat foreshortened) 50μ (50μ-58μ) in length; three pairs of genital acetabula; epimeroglandularia 2 located in a line with the posterior end of the first acetabula (fig. 51); dorsal lengths of the palpal segments: P-I, 20μ (20μ-21μ); P-II, 36μ (33μ-37μ); P-III, 25μ (23μ-26μ); P-IV, 45μ (41μ-48μ); P-V, 19μ (18μ-21μ); morphology of palp as in the female; dorsal lengths of the distal segments of the first leg: I-Leg-4, 50μ (47μ-53μ); I-Leg-5, 63μ (61μ-67μ); I-Leg-6, 86μ (80μ-86μ); legs as in female.

Holotype: Adult ♀, from a gravel bar in the Jack's Fork River at junction with Alley Spring, Shannon County, Missouri, July 14, 1961 (river temperature 27° C., spring temperature 14° C.).

Allotype: Adult ♂, same data as holotype.

Paratypes: Two ♂♂, same data as holotype; 1 ♂, 2 ♀♀, taken in a gravel bar in the Black River on County Road CC approximately five miles west of Gads Hill, Reynolds County, Missouri, July 8, 1960: 1 ♀, from a gravel bar in the St. Francis River at State Camp "Sam A. Baker", Wayne County, Missouri, July 9, 1960 (temperature 28° C. in holes dug in the gravel bar); 1 ♂, same data as preceding collection, on June 26, 1961; 1 ♂, found in a gravel bar in the Meramec River approximately 11 miles northeast of Salem, Dent County, Missouri, July 19, 1960 (temperature 22° C.); 1 ♀, from Little Back Creek, on route 39 three miles from the West Virginia border, Bath County, Virginia, July 25, 1964; 1 ♂, 2 ♀♀, from gravel deposits in a stream near Griffen (on Route 8 three miles from the Warren County line), Hamilton County, New York, August 19, 1964; 2 ♂♂, 1 ♀, same locality on August 30, 1968 (temperature 17° C.).

Discussion: The new species is the only interstitial member of the *aspera* group. It also differs in being much smaller and having reduced pigmentation on both the dorsal and ventral shields.

17. Mideopsis (Xystonotus) vincina, new species

(Figures 52, 54, 56, 58, 106)

Female: Dorsal shield 494μ in length, 406μ in width; dorsal shield with a pair of conspicuous lateral ridges which converge posteriorly into a somewhat rounded V-shape; color pattern consisting of right and left patches which fuse medially in posterior portion of dorsal shield as shown for the male (fig. 106); ventral shield 536μ in length, 471μ in width; dorsal rim of ventral shield relatively wide (28μ laterally); edges of ventral shield tending to be wavy and with well developed projections at posterior end (fig. 54); venter heavily pigmented; capitular bay a rounded V-shape; median suture lines of fourth coxae short; a ridge present on each side extending anterolaterally from the region of insertions of the fourth legs; genital bay shallow, most of the genital field not lying in the genital bay; gonopore 78μ in width; three pairs of genital acetabula; raised area flanking the gonopore relatively wide; dorsal lengths of the palpal segments: P-I, 25μ; P-II, 39μ; P-III, 29μ; P-IV, 55μ; P-V-, 21μ; figure 52

shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 61μ; I-Leg-5, 69μ; I-Leg-6, 85μ; leg segments stocky, swimming hairs absent.

Male: Dorsal shield 410μ in length, 334μ in width; dorsal shield as described for the female but groupings of the body pores (fig. 106) unusual; ventral shield 486μ in length 410μ in width; except in structure of the posterior end, male similar to that illustrated and described for the female; dorsal rim of ventral shield 34μ in width laterally; gonopore (somewhat foreshortened) 78μ in length; three pairs of genital acetabula; posterior end of ventral shield lacking the pronounced projections exhibited by the female (more as in the female of the related species, figure 40); epimeroglandularia 2 located in a line with the posterior end of the first acetabula; dorsal lengths of the palpal segments: P-I, 21μ; P-II, 35μ; P-III, 28μ; P-IV, 52μ; P-V, 20μ; palp similar to that illustrated for the female; dorsal lengths of the distal segments of the first leg: I-Leg-4, 59μ; I-Leg-5, 66μ; I-Leg-6, 83μ; legs as in the female.

Holotype: Adult ♀, collected in the Cowpasture River on County Road 629 approximately three miles northeast of McClung, Bath County, Virginia, September 9, 1968 (temperature 19° C.).

Allotype: Adult ♂, same data as holotype.

Discussion: The new species differs most noticeably from other members of the *aspera* group in the structure of the posterior end of the female ventral shield (compare figure 54 with figures 40, 42, 45). The male does not exhibit the projections at the posterior end, but in the one known specimen the pores of the dorsal shield show a clustering into distinct groups which have a common internal opening (fig. 106). These clusters are either much less pronounced or absent in males of other species.

18. Mideopsis (Xystonotus) lamprima, new species

(Figures 59-61, 109)

Female: Dorsal shield 582μ in length, 471μ in width; dorsal shield with a narrow median ridge and two pairs of low, more laterally placed longitudinal ridges; glandularia located on most lateral pair of ridges; longitudinal striations prominent; figure 109 shows the color pattern and arrangement of the ridges of the dorsum; ventral shield 650μ in length, 547μ in width; edges of ventral shield somewhat irregular; fourth coxae pigmented; capitular bay V-shaped; median suture lines of fourth coxae reduced; a ridge present on each side extending anterolaterally from area of insertion of the fourth legs; continuations of the latter ridges extending well posterior to the insertions of the fourth legs; genital bay shallow, with much less than one-half the genital field located in it; gonopore 85μ in width; three pairs of genital acetabula; epimeroglandularia 2 located in a line with the anterior end of the gonopore (fig. 60); dorsal lengths of the palpal segments: P-I, 27μ; P-II, 48μ; P-III, 38μ; P-IV, 68μ; P-V, 28μ; figure 61 illustrates the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 76μ; I-Leg-5, 90μ; I-Leg-6, 107μ; figure 59 shows these segments; swimming hairs absent.

Male: Unknown.

Holotype: Adult ♀, collected in mosses on rocks in a small stream at Cowen's Gap State Park, Fulton County, Pennsylvania, May 21, 1961 (temperature 9° C.).

Discussion: The structure of the dorsal shield, with its five longitudinal ridges (fig. 109) is diagnostic.

19. Mideopsis (Xystonotus) robusta (Habeeb)

(Figures 53, 55, 57, 62, 110)

Xystonotus robustus Habeeb, 1954. Leaflets Acadian Biol., 4: 6.

Female: Dorsal shield 753μ-790μ in length, 562μ-593μ in width; dorsal shield with a pair of long, more or less unpigmented depressions forming a narrow V-shape; longitudinal striations prominent in the area flanking this "V"; figure 110 shows the structure and color pattern of the dorsal shield; ventral shield 775μ-836μ in length, 729μ-760μ in width; dorsal rim of ventral shield very wide (60μ-74μ in width laterally); edges of ventral shield relatively smooth; color patches of venter consisting of two pairs of small pigmented areas near the anterior end (fig. 57); capitular bay V-shaped; median suture lines of fourth coxae short, reduced nearly to median angles; a ridge present on each side extending anterolaterally from region of insertion of the fourth legs; genital bay very shallow, containing very little of the genital field; gonopore 96μ-110μ in width; three pairs of genital acetabula; epimeroglandularia 2 located in a line with the anterior end of the gonopore; dorsal lengths of the palpal segments: P-I, 31μ-33μ; P-II, 49μ-54μ; P-III, 38μ-41μ; P-IV, 69μ-77μ; P-V, 27μ-28μ; figure 53 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 80μ-89μ; I-Leg-5, 90μ-100μ; I-Leg-6, 107μ-122μ; figure 55 illustrates these segments; swimming hairs absent.

Male: Dorsal shield 638μ in length, 517μ in width; dorsal shield as described for the female; ventral shield 716μ in length, 653μ in width; except for genital field region, ventral shield as described for the female; gonopore 133μ in length; three pairs of genital acetabula; epimeroglandularia 2 located opposite anterior end of gonopore (fig. 62); dorsal lengths of the palpal segments: P-I, 33μ; P-II, 47μ; P-III, 38μ; P-IV, 66μ; P-V, 26μ; morphology of palp as in the female; dorsal lengths of the distal segments of the first leg: I-Leg-4, 93μ; I-Leg-5, 104μ; I-Leg-6, 138μ; leg segments proportionally somewhat longer than in female but otherwise similar.

Habitat and Distribution: This species occurs in ponds and small lakes. It is uncommon but has a wide distribution in Northeastern North America. Habeeb (1954) records it from two localities in New Brunswick and from a pond in New Jersey. I have taken single specimens in the swampy end (pond conditions) of Wall Lake, Barry County, Michigan, September 1, 1955 and from a small lake along Highway US 71 approximately six miles south of entrance to Itasca State Park, Hubbard County, Minnesota, June 23, 1954. The collections of the Royal Ontario Museum contain a single specimen found in a pond beside Route 11, 2.5 miles east of Smooth Rock Falls, Cochrane District, Ontario, June 26, 1971.

Discussion: The relatively large size, wide dorsal rim of the ventral shield, and characteristic ridges, color pattern and longitudinal striations of the dorsal shield are diagnostic. *M. lamprima* has a somewhat similar color pattern but has a different arrangement of the dorsal ridges (compare figures 109, 110). Also, with the exception of *M. aspera*, it is the only "standing water" species known for the subgenus.

20. Mideopsis (Xystonotus) wolcotti, new species

(Figures 63-65, 108)

Male: (Only two specimens of this species have been collected and one of these was left in KOH for 48 hours, distorting it too much to permit accurate measurements); dorsal shield 562μ in length, 426μ in width; dorsal shield with a V-shaped area of smaller pores which is only slightly raised laterally (fig. 108); dorsum without striations or a distinct color pattern; ventral shield 592μ in length, 522μ in width; dorsal rim of ventral shield (area joining the dorsal shield) of only moderate width (approximately 30μ laterally); edges of ventral shield somewhat irregular; no ventral color pattern; capitular bay a rounded V-shape; median suture lines of fourth coxae short (fig. 63); a ridge present on each side extending anterolaterally from the region of insertion of the fourth legs; genital bay of moderate depth, containing approximately one-half of the genital field; gonopore 118μ in length; three pairs of genital acetabula; epimeroglandularia 2 located in a line with the anterior pair of acetabula; dorsal lengths of the palpal segments: P-I, 27μ; P-II, 48μ; P-III, 37μ; P-IV, 67μ; P-V, 24μ; figure 64 shows the structure of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 72μ; I-Leg-5, 86μ; I-Leg-6, 112μ; figure 65 illustrates these segments; leg segments stocky, swimming hairs absent.

Female: Unknown.

Holotype: Adult ♂, collected in Glass Creek near its source (T2N/R9W/S7), Barry County, Michigan, July 27, 1959.

Paratype: One ♂, from Power's Creek near Hastings (T4N/R9W/S32), Barry County, Michigan, May 15, 1967.

Discussion: The present species seems most closely related to the European member of the subgenus, *M. willmanni* Viets. The North American species is smaller, has the V-shaped marking on the dorsal shield more widely separated at the posterior end, and has a somewhat longer median margin of the fourth coxae. Among the North American species *M. wolcotti* seems most related to the following two forms from interstitial waters, *M. sabulonis* and *M. paramecia*, but differs in being proportionally wider, having a shorter median margin of the fourth coxae, and a deeper genital bay.

21. Mideopsis (Xystonotus) sabulonis, new species

(Figures 66-69, 111)

Female: Dorsal shield 525μ (525μ-566μ) in length, 410μ (410μ-441μ) in width; dorsal shield with a V-shaped area, bearing smaller pores, which is slightly raised laterally; color pattern and longitudinal striations absent (fig. 111); ventral shield 578μ (578μ-608μ) in length, 456μ (448μ-479μ) in width; dorsal rim of ventral shield (area joining the dorsal shield) narrow (approximately 17μ in width laterally); edges of ventral shield relatively smooth; no ventral color pattern; capitular bay a rounded V-shape; tips of first coxae extending slightly beyond anterior edge of body; median suture lines of fourth coxae of moderate length (fig. 67); a ridge present on each side extending anterolaterally from region of insertion of the fourth legs; distance between these ridges in area of insertion of the fourth legs 318μ (303μ-318μ); genital bay shallow, enclosing only a small portion of the genital field; gonopore 63μ (63μ-68μ) in width; three pairs of genital acetabula; epimeroglandularia 2

located in a line with the first pair of acetabula; dorsal lengths of the palpal segments: P-I, 26μ (24μ-26μ); P-II, 46μ (42μ-46μ); P-III, 34μ (34μ-35μ); P-IV, 59μ (59μ-63μ); P-V, 22μ (21μ-24μ); figure 66 illustrates the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 72μ (72μ-76μ); I-Leg-5, 86μ (86μ-88μ); I-Leg-6, 117μ (117μ-122μ); figure 69 shows these segments; leg segments stocky, swimming hairs absent.

Male: Dorsal shield 547μ in length, 425μ in width; dorsal shield as described for the female; ventral shield 592μ in length, 456μ in width; except for genital field region, ventral shield as described and illustrated for the female; width between ridges in area of insertion of the fourth legs 310μ; gonopore 96μ in length; epimeroglandularia 2 located in a line with the posterior end of the first acetabula (fig. 68); dorsal lengths of the distal segments of the first leg: I-Leg-4, 76μ; I-Leg-5, 87μ; I-Leg-6, 117μ; legs as described and illustrated for the female.

Holotype: Adult ♀, collected in a gravel bar in a tributary of the Jackson River approximately 1.5 miles south of Bacova, Bath County, Virginia, May 19, 1961.

Allotype: Adult ♂, same data as holotype.

Paratypes: Two ♀♀, same data as holotype.

Discussion: *M. sabulonis* is most closely related to the following species, *M. paramecia* (see discussion under the latter). It also has some affinities with *M. wolcotti* but differs as follows: *M. sabulonis* is proportionally narrower with a smooth edge on the ventral shield. The present species also has a much longer median margin on the fourth coxae and a shallower genital bay. There is also a habitat difference, for the present species is an interstitial water form.

22. Mideopsis (Xystonotus) paramecia, new species

(Figures 70, 112)

Female: Dorsal shield 486μ (471μ-486μ) in length, 358μ (334μ-358μ) in width; dorsal shield with a V-shaped area, bearing smaller pores, which is slightly raised laterally; color pattern and longitudinal striations absent (fig. 112); ventral shield 532μ (502μ-532μ) in length, 395μ (365μ-395μ) in width; dorsal rim of ventral shield (area joining the dorsal shield) narrow (13μ-17μ) in width; edges of ventral shield relatively smooth; color absent from ventral shield; capitular bay a rounded V-shape; tips of first coxae projecting beyond anterior end of body; median suture lines of fourth coxae relatively long (fig. 70); a ridge present on each side extending anterolaterally from area of insertion of the fourth legs; distance between these ridges in the area of insertion of the fourth legs 266μ (244μ-266μ); genital bay shallow, enclosing only a small portion of the genital field; gonopore 57μ (52μ-57μ) in width; three pairs of genital acetabula; epimeroglandularia 2 placed in a line with the anterior end of the gonopore; dorsal lengths of the palpal segments: P-I, 24μ (24μ-25μ); P-II, 38μ (36μ-38μ); P-III, 28μ (28μ-30μ); P-IV, 55μ (52μ-55μ); P-V, 21μ (19μ-22μ); dorsal lengths of the distal segments of the first leg: I-Leg-4, 69μ (63μ-69μ); I-Leg-5, 80μ (74μ-80μ); I-Leg-6, 104μ (96μ-104μ); structure of palp and legs similar to that described and illustrated for the preceding species, M. sabulonis.

Male: Unknown.

Holotype: Adult ♀, collected in gravel deposits of a stream at Perry City (Junction of Route 228 and Town Line Road), Schuyler County, New York, August 29, 1968.

Paratypes: One ♀, same data as holotype; 1 ♀, from a gravel bar in the North Branch of the Meduxnekeag River at Monticello, Aroostook County, Maine, August 28, 1964.

Discussion: The present species is most closely related to *M. sabulonis*, both of which are interstitial water species occuring in Eastern North America. *M. paramecia* differs most noticeably in its proportionally much narrower body and much longer medial margins of the fourth coxae (compare figures 67, 70).

23. Mideopsis (Xystonotus) pumila Cook

(Figures 72-75, 113)

Mideopsis pumila Cook, 1974. Mem. Amer. Ent. Inst., 21: 464.
Herbsmideopsis pumila Habeeb, 1975. Leaflets Acadian Biol., 64: 3.

Female: Dorsal shield 364μ in length, 285μ in width; dorsal shield oval, dorsal shield with an area of smaller pores in the form of a rounded V-shape; pigmentation absent; figure 113 shows the structure of the dorsal shield; eye pigment reduced; ventral shield 426μ in length, 319μ in width; capitular bay V-shaped; first and second coxae projecting beyond the end of the body; median suture lines of third and fourth coxae well developed, those of the fourth coxae proportionally very long; a ridge present on each side extending anteriorly from the region of insertion of the fourth legs; genital bay relatively deep and enclosing somewhat more than one-half the genital field; gonopore 33μ in width; three pairs of genital acetabula; gland portion of epimeroglandularia 2 absent, gland portion of epimeroglandularia 1 reduced (fig. 73); two pairs of small cup-like structures present immediately lateral to the lateral edges of the fourth coxae; dorsal lengths of the palpal segments: P-I, 17μ; P-II, 27μ; P-III, 21μ; P-IV, 44μ; P-V, 15μ; palpal chaetotaxy reduced; the unusual proportions of the palp better illustrated (fig. 75) than described; dorsal lengths of the distal segments of the first leg: I-Leg-4, 41μ; I-Leg-5, 52μ; I-Leg-6, 74μ; figure 72 shows these segments; leg segments very stocky, swimming hairs absent.

Male: Dorsal shield 349μ-410μ in length, 273μ-304μ in width; dorsal shield as described for the female; ventral shield 403μ-471μ in length, 307μ-312μ in width; except for genital field area, ventral shield as shown and described for the female; gonopore 50μ-59μ in length; three pairs of genital acetabula; figure 74 illustrates the morphology of the genital field; dorsal lengths of the palpal segments: P-I, 15μ-17μ; P-II, 28μ-30μ; P-III, 21μ-22μ; P-IV, 42μ-47μ; P-V, 16μ-20μ; dorsal lengths of the distal segments of the first leg: I-Leg-4, 41μ-45μ; I-Leg-5, 55μ-65μ; I-Leg-6, 76μ-91μ; structure of palp and legs as in the female.

Habitat and Distribution: This is an interstitial water species which has been taken in sand and gravel deposits of streams in Wyoming, Montana and Oregon.

Discussion: *M. pumila* and the following species, *M. pallida*, are members of a very distinct species group characterized by the projecting anterior coxae, broad median margins of the fourth coxae; reduction in size of epimeroglandularia 1 and loss of epimeroglandularia 2, and presence of two pairs of small cup-like structures lateral to the lateral margins of the fourth coxae. See discussion section under the following species for characters which will separate the two.

Habeeb (1975) has proposed the new genus *Herbsmideopsis* for *pumila*. He states that it differs from *Xystonotus* in its relatively shorter leg segments, long median margin of the fourth coxae and "more evolved design of the process

on the venter of the P. IV". A glance at the drawings of I-Leg-4-6 of other species of *Xystonotus*, especially Habeeb's own species, *delicata* (fig. 47), will indicate that degree of leg stockiness is only a species character. The length of the median margins of the fourth coxae is at first striking when compared to the type species of *Xystonotus* (fig. 42). However, another interstitial species, *M. paramecia*, has median margins of the fourth coxae nearly as long as in *pumila*. The North American species exhibit a graded series as far as length of the median margins of the fourth coxae is concerned from that of *pumila* to the median angles found in *aspera* (see figures 73, 70, 67, 40, 42). The palp of *pumila* is unusual (fig. 75) but that of the closely related species (fig. 78), except for a slightly reduced chaetotaxy, is not very different from other members of the subgenus *Xystonotus*. Although *M. pumila* and the related *M. pallida* are not really distinct in any of the characters mentioned by Habeeb, they are unusual in that there has been a loss of the gland portion of epimeroglandularia 2. However, the absence of the gland portion of the glandularia is also found in other interstitial water mites (certain *Feltria*, and *Stygomamersopsis*), and does not seem to justify generic separation. The two pairs of cup-like structures flanking the fourth coxae are unique among the Mideopsidae, but again do not seem to be a difference profound enough to establish a new genus. For the reasons discussed *Herbsmideopsis* is placed in synonymy with *Mideopsis* and tentatively in synonymy with *Xystonotus*.

24. Mideopsis (Xystonotus) pallida, new species

(Figures 76-78, 114)

Female: Dorsal shield 393μ (380μ-410μ) in length, 308μ (304μ-319μ) in width; dorsal shield similar to that described for *pumila* but the arms of the V-shaped marking tend to be farther apart (compare figures 113, 114); integumental pigmentation absent, eye pigment reduced; ventral shield 471μ (433μ-471μ) in length, 338μ (334μ-350μ) in width; capitular bay V-shaped; first and second coxae projecting beyond anterior end of the body; median suture lines of third and fourth coxae well developed, and those of the fourth coxae long; a ridge present on each side extending anterolaterally from the area of insertion of the fourth legs; genital bay well developed, enclosing approximately one-half of the genital field; gonopore 41μ (41μ-43μ) in width; three pairs of genital acetabula; gland portion of epimeroglandularia 1 reduced, that of epimeroglandularia 2 absent but associated setae present to indicate the former location; two pairs of small cup-like structures located immediately lateral to the posterolateral margins of the fourth coxae; figure 77 illustrates the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, 17μ (17μ-20μ); P-II, 31μ (31μ-34μ); P-III, 24μ (24μ-26μ); P-IV, 51μ (50μ-52μ); P-V, 20μ (20μ-21μ); ventral tubercle on P-IV truncate at tip and more widely separated from the distal portion of the segment than in the related species (compare figures 75, 78); dorsal lengths of the distal segments of the first leg: I-Leg-4, 45μ (43μ-45μ); I-Leg-5, 60μ (60μ-62μ); I-Leg-6, 82μ (82μ-85μ); figure 76 shows the proportions and chaetotaxy of these segments; swimming hairs absent.

Male: Unknown.

Holotype: Adult ♀, collected in a gravel bar in Whitewater Creek approximately five miles northeast of Glenwood, Catron County, New Mexico, July 13, 1966.

Paratypes: Two ♀♀, same data as holotype.

Discussion: The new species is most closely related to *M. pumila* Cook. *M. pallida* differs most noticeably in the structure of the palp, with the ventral tubercle on P-IV truncate and more removed from the distal portion of the segment. Also, P-V is distinctly longer in the new species (compare figures 75, 78).

25. Mideopsis (?Xystonotus) expositor (Habeeb)

(Figure 71)

Xystonotus expositor Habeeb, 1963. Leaflets Acadian Biol., 33: 4.

I have not seen the type material on which this species was based and have not collected specimens which can be assigned to it. The swimming hairs described by Habeeb plus the unusual arrangement of the "prominent lines" on the dorsal shield (fig. 71) are not what one would expect in a member of the subgenus *Xystonotus*, and its placement remains uncertain.

Following is Habeeb's description (figure 71 is a copy of the only illustration included): XYSTONOTUS EXPOSITOR, n. sp., female; related and close to Xystonotus Willmanni Viets, but differing in being larger, in having finer, less prominent lines in the dorsal shield -- definitely not forming a "V" design, and in having two or three vestigial swimming hairs on ends of segments 3, 4, 5 of legs II, III and IV; dorsum measuring 870 by 775 microns (L by W); genital slit 185 microns (L); IV L. 6 180 microns (L); see figure 8 (note: this is figure 71 of the present paper); male except for being smaller with a narrower genital opening is similar to the female; dorsum 760 by 685 microns (L by W); IV L. 6 165 microns (L). CALIFORNIA: In brook of San Antonio Canyon, 2 miles north of village of Mt. Baldy, Los Angeles Co., August 12, 1963. Same brook 2 miles south of village of Mt. Baldy, August 12, 1963.

Habeeb (1967) in his "Check List of North American Water-Mites" names a new subspecies, *Collieri*, under *expositor*, stating that it differed from the typical subspecies in lacking swimming hairs. Habeeb seems to have a somewhat less than modern subspecies concept for the new "subspecies" was also collected in San Antonio Canyon. Later, Habeeb (1974) raised *Collieri* to the rank of species.

Hopefully, future collecting at or near the type locality will produce specimens which will allow an adequate description of *expositor*, determine its subgeneric placement with certainty, and determine the status of *collieri*.

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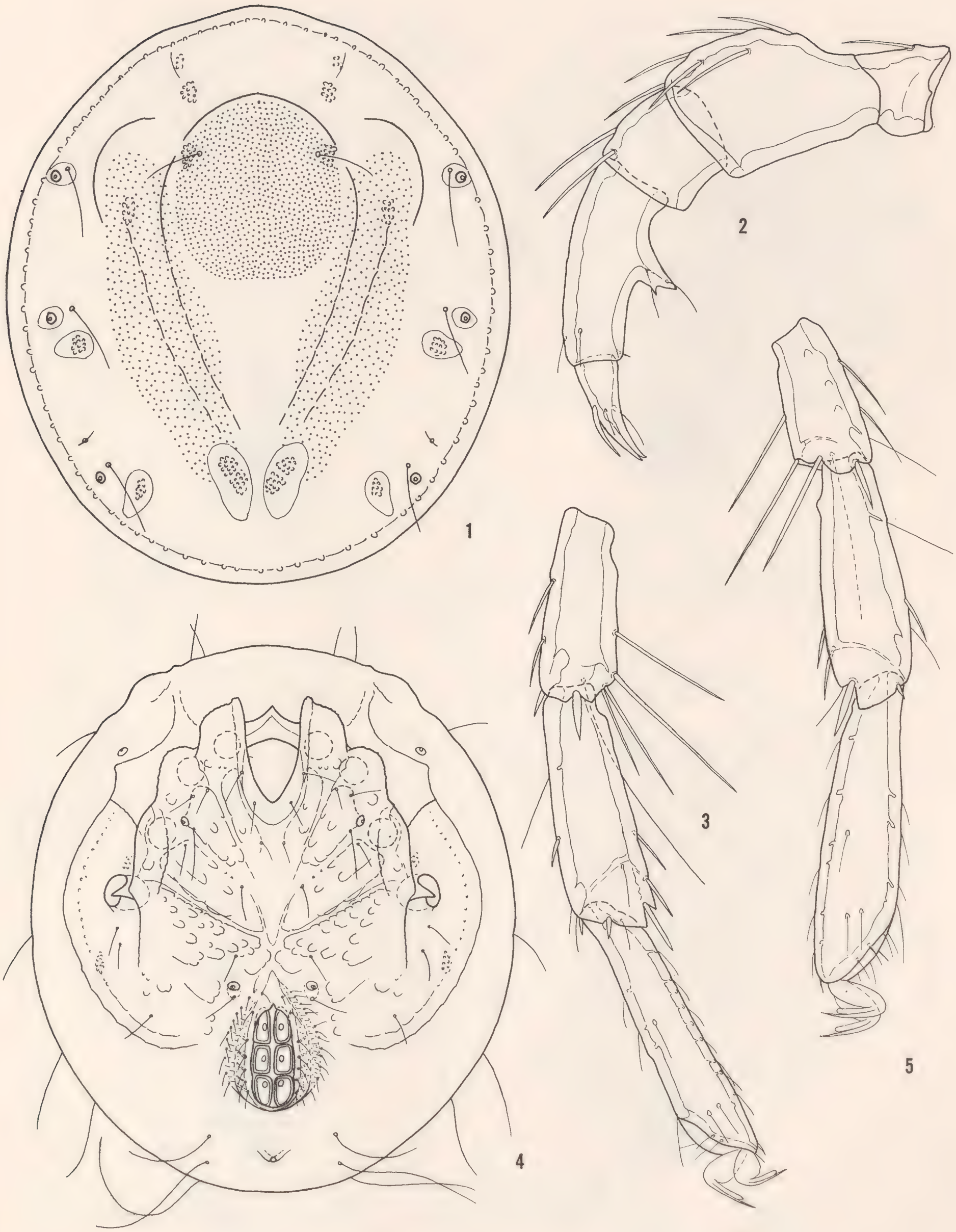
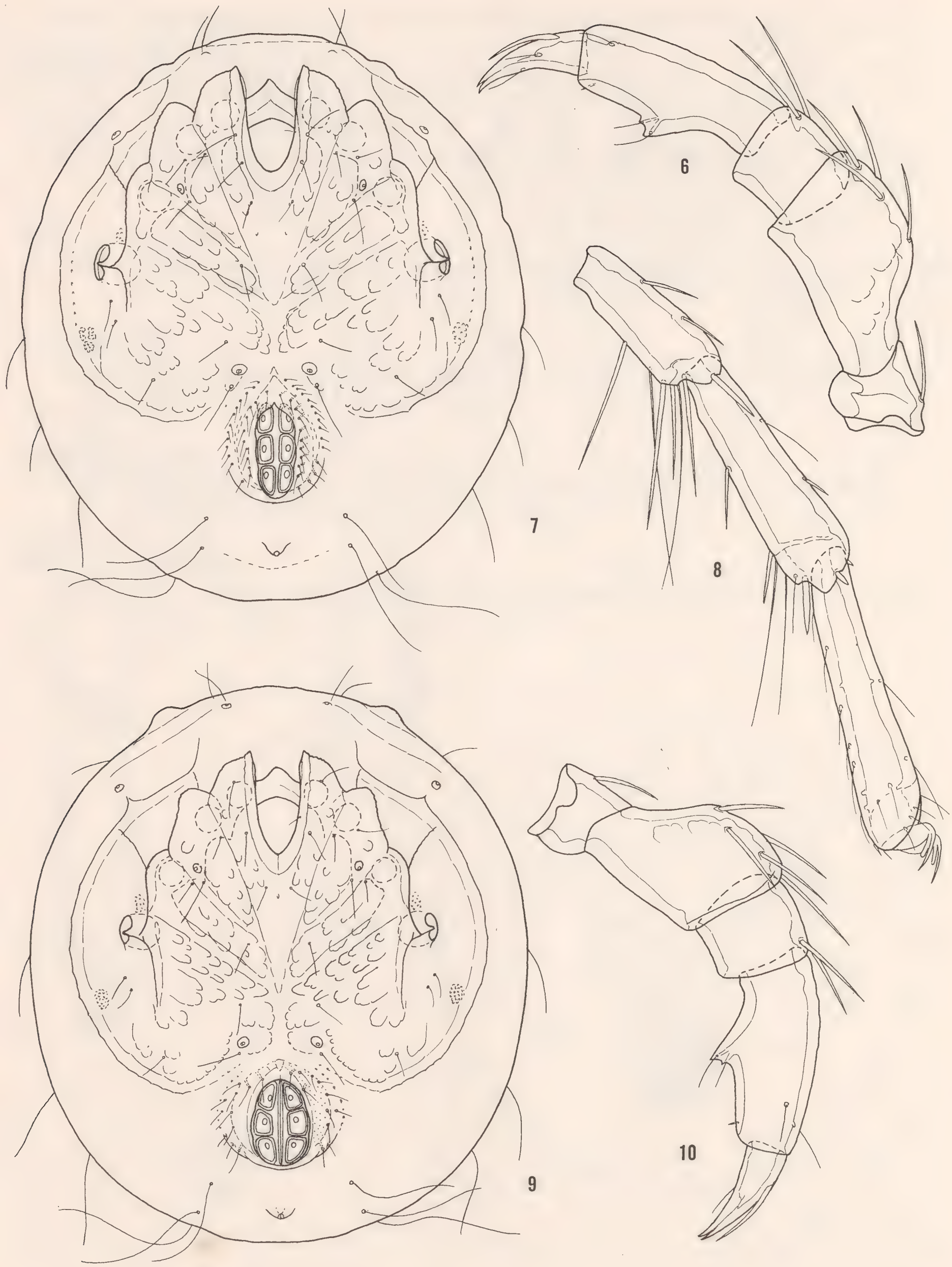
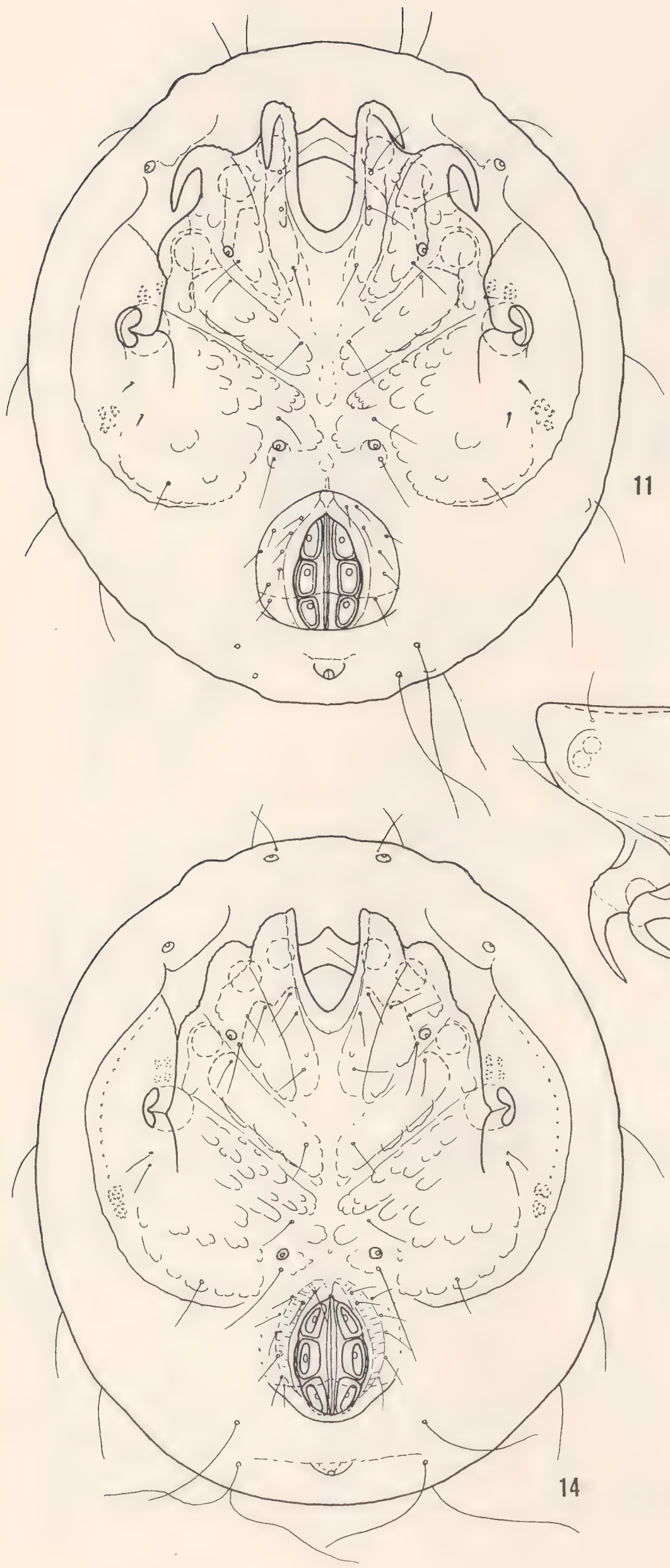
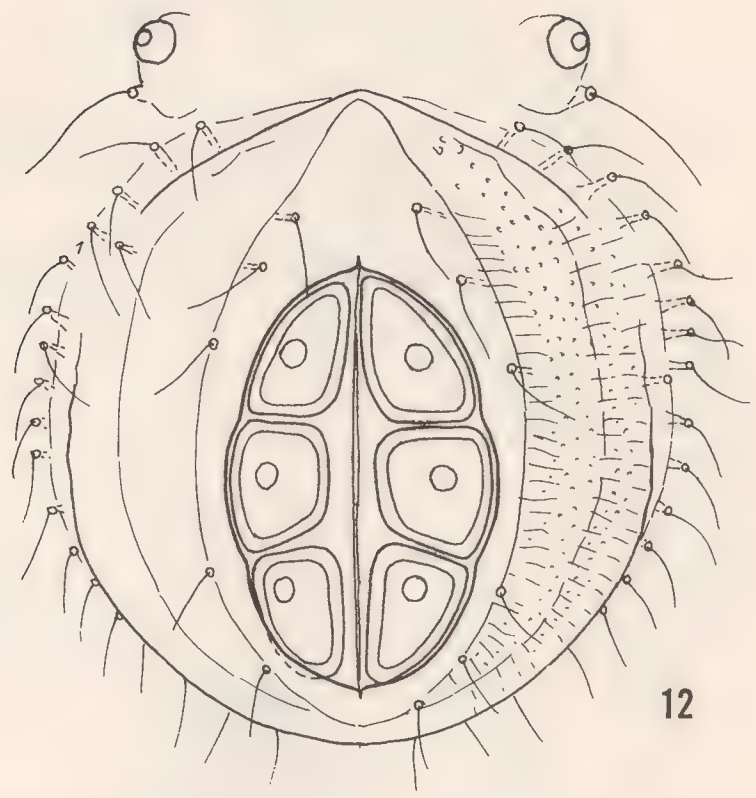


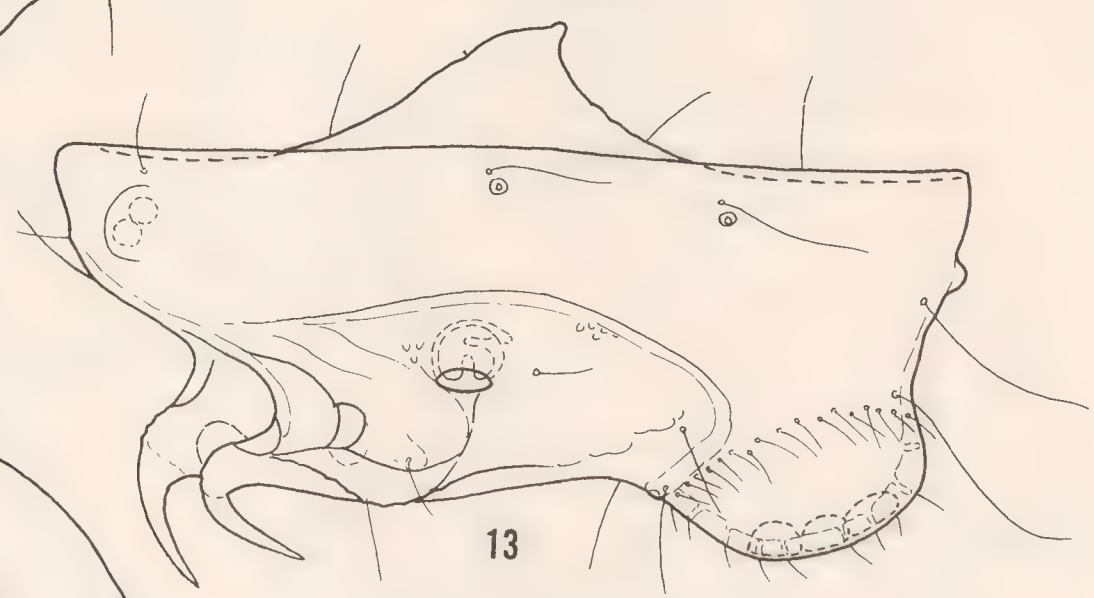
Fig. 1, diagramatic drawing of the dorsal shield of a member of the Mideopsis orbicularis group.
Mideopsis jacunda n. sp. Fig. 2, palp, male; Fig. 3, I-Leg-4-6, male.
Mideopsis borealis borealis Habeeb Fig. 4, ventral shield, male; Fig. 5, I-Leg-4-6, male.

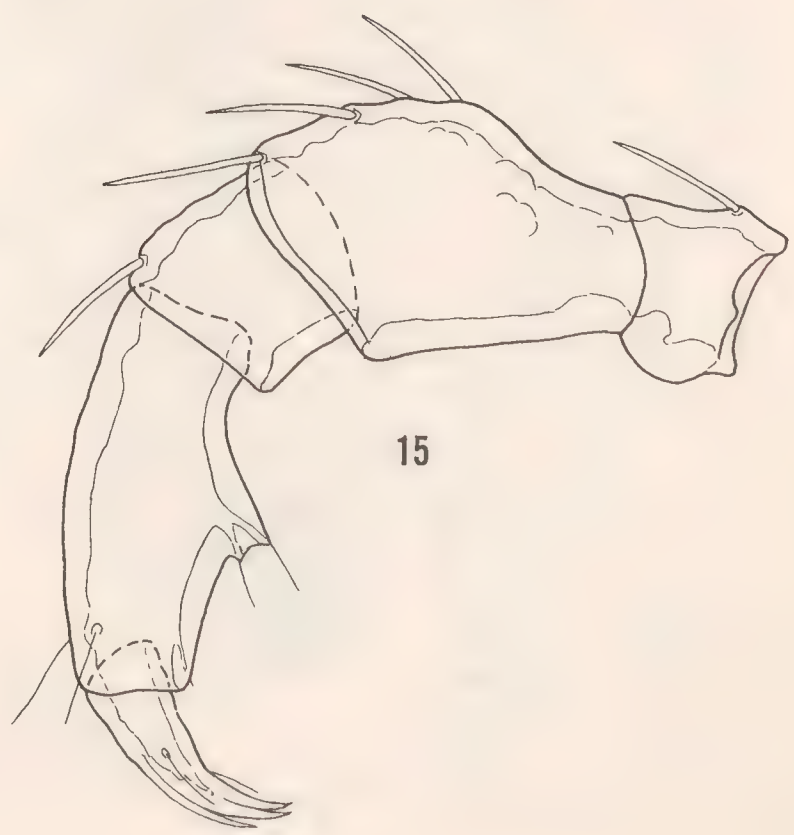


Mideopsis jacunda n. sp. Fig. 7, ventral shield, male.
Mideopsis fibrosa Lundblad Fig. 6, palp, female; Fig. 8, I-Leg-4-6, female; Fig. 9, ventral shield, female.
Mideopsis borealis borealis Habeeb Fig. 10, palp, male.

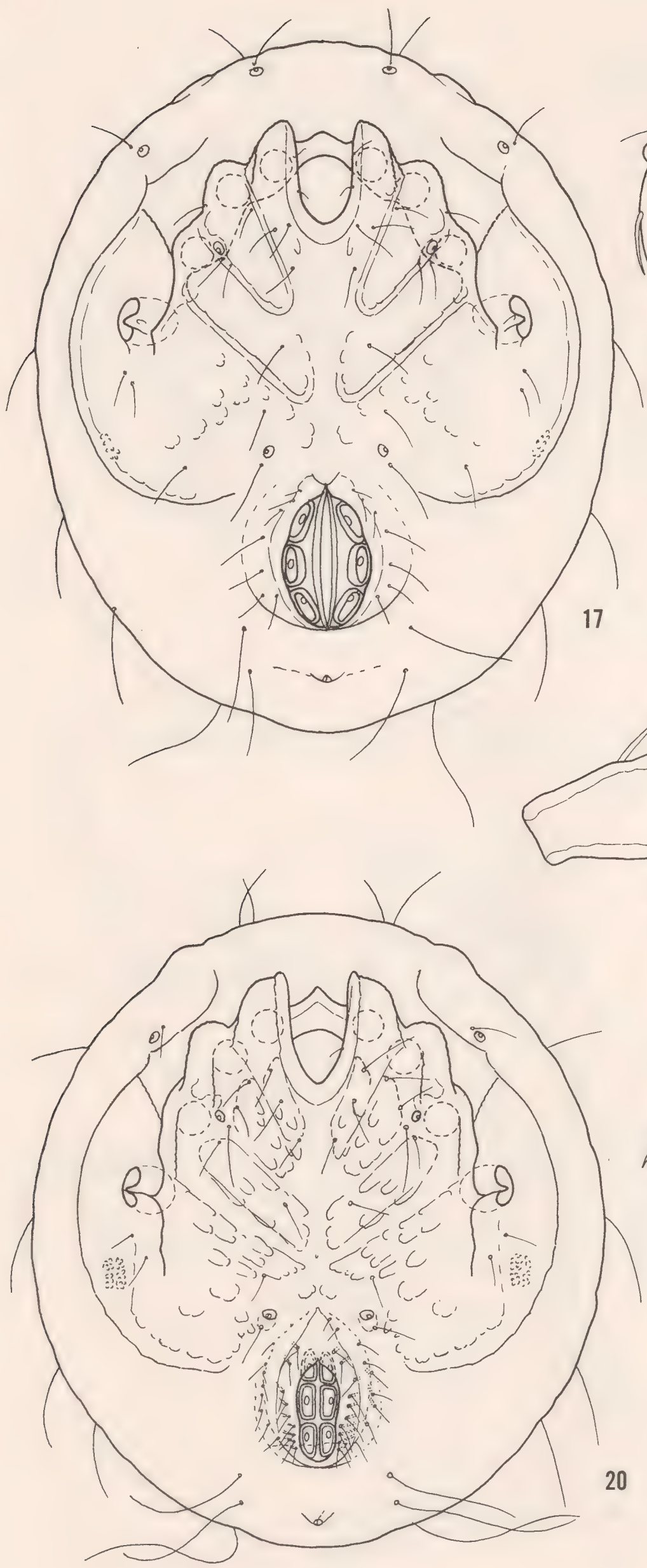


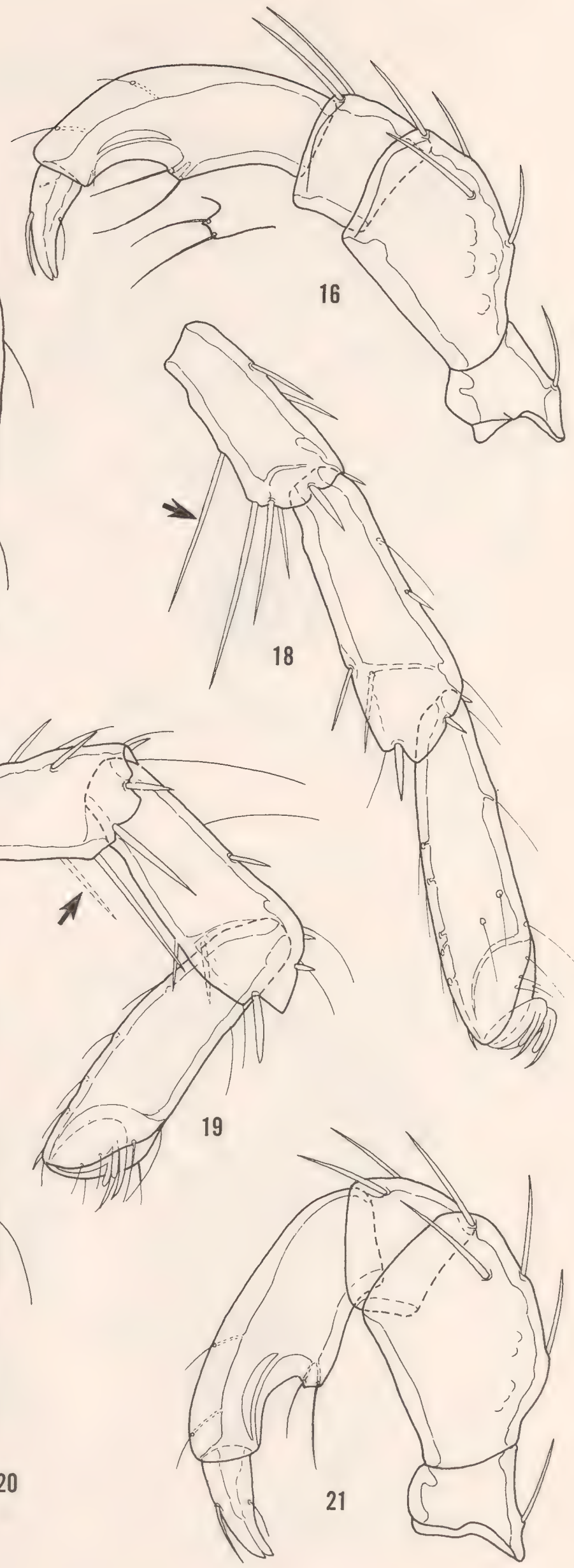




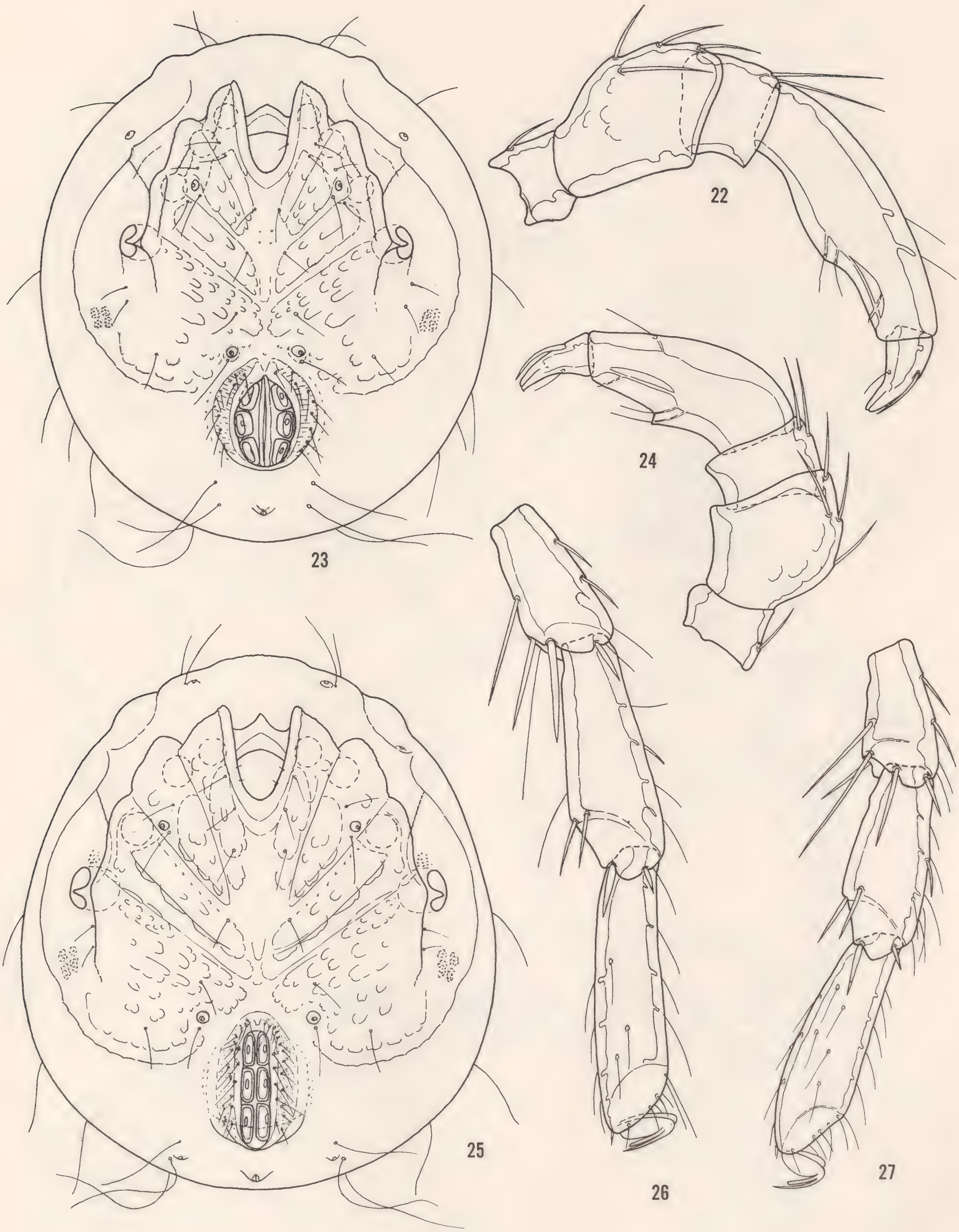


Mideopsis gladiator Habeeb Fig. 11, ventral shield, female; Fig. 12, genital field, male; Fig. 13, lateral view, male; Fig. 15, palp, female.
Mideopsis americana Marshall Fig. 14, ventral shield, female.

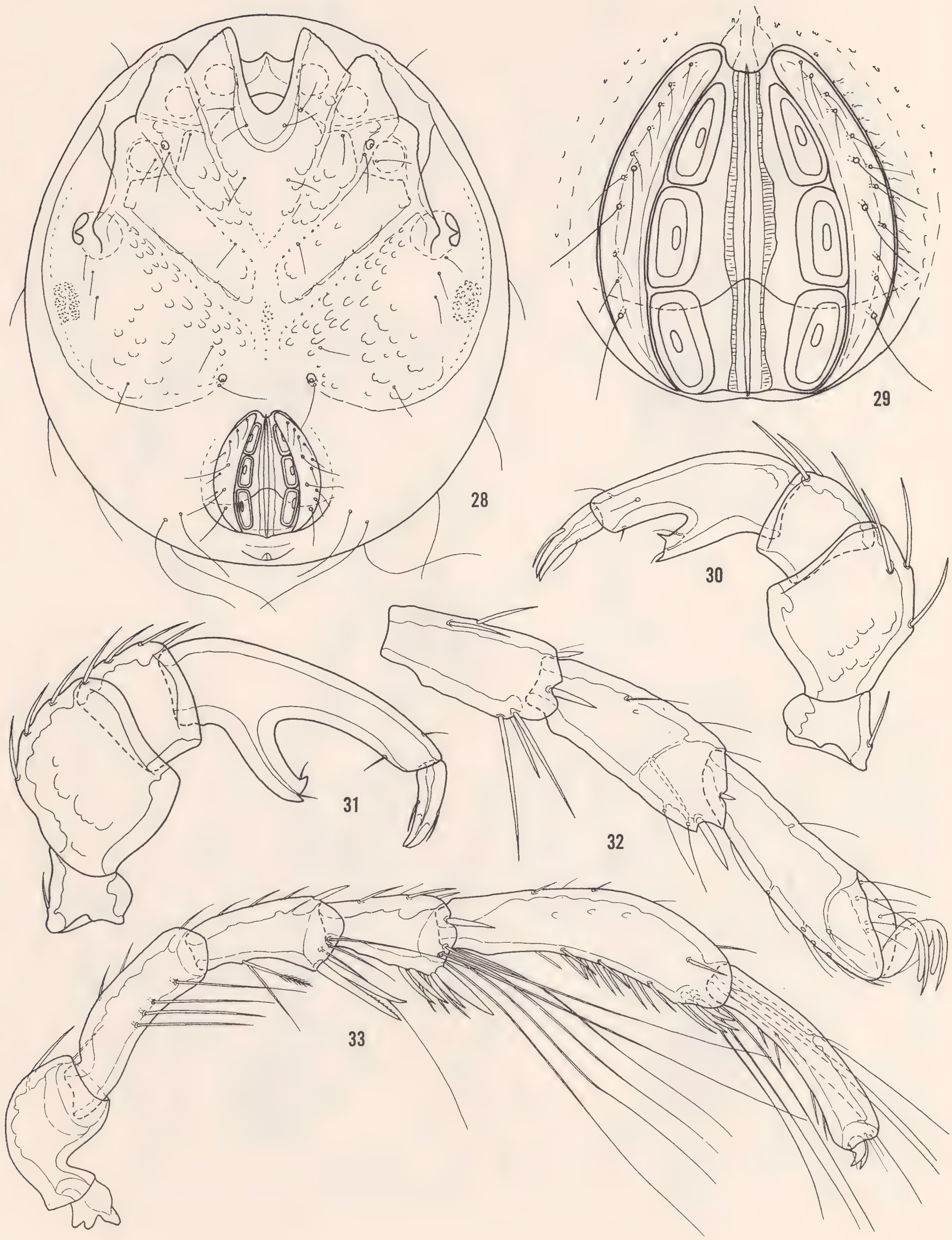




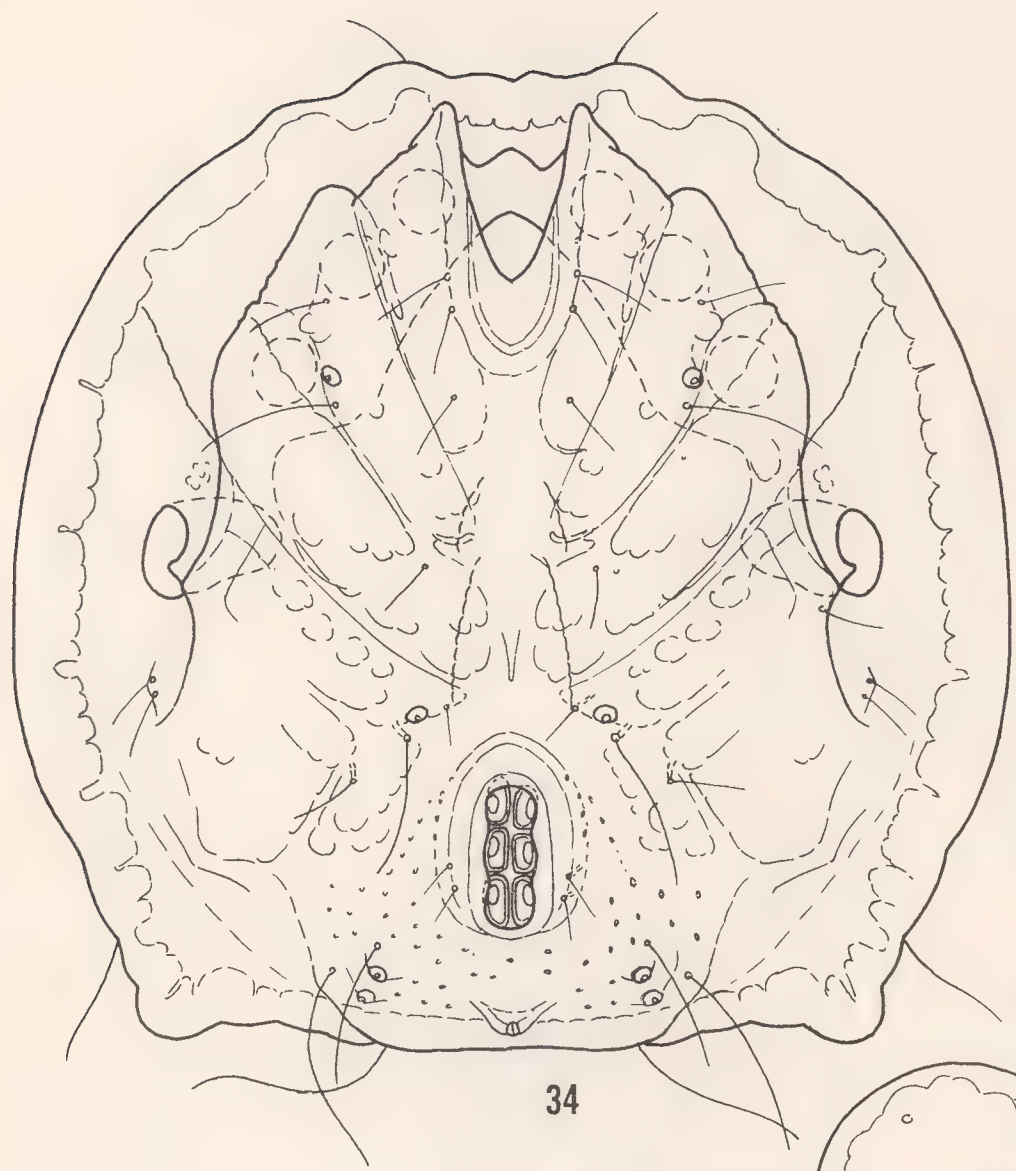
Mideopsis olseni n. sp. Fig. 17, ventral shield, female; Fig. 19, I-Leg-4-6, female; Fig. 21, palp, female.
Mideopsis americana Marshall Fig. 16, palp, female; Fig. 18, I-Leg-4-6, female.
Mideopsis lamellipalpis Lundblad Fig. 20, ventral shield, male.

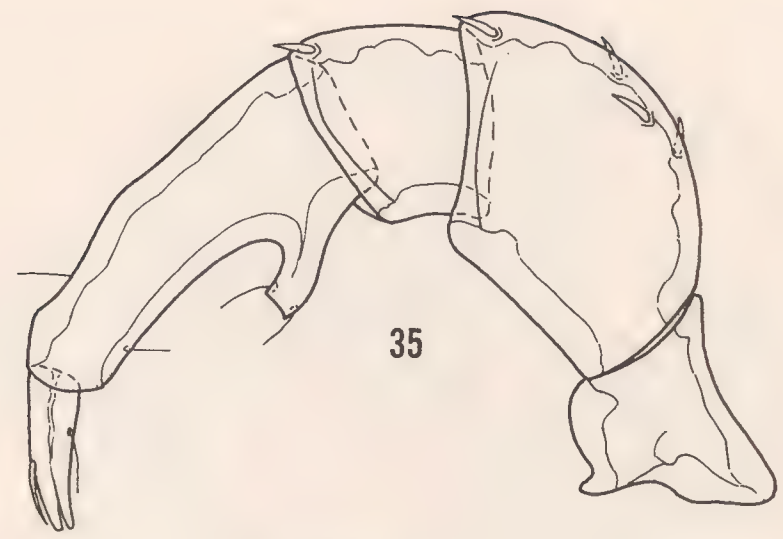


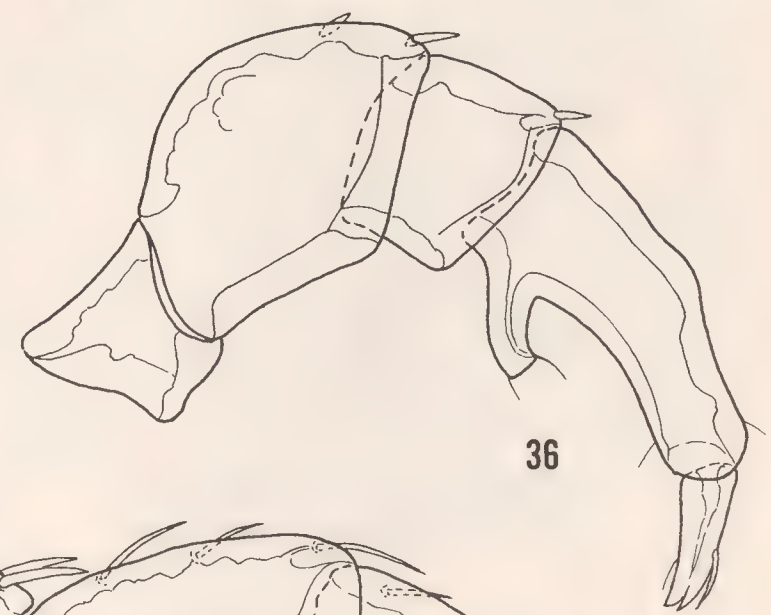
Mideopsis marshallae n. sp. Fig. 22, palp, female; Fig. 23, ventral shield, female; Fig. 26, I-Leg-4-6, female.
Mideopsis lamellipalpis Lundblad Fig. 24, palp, male; Fig. 27, I-Leg-4-6, male.
Mideopsis crassipes Soar Fig. 25, ventral shield, male.

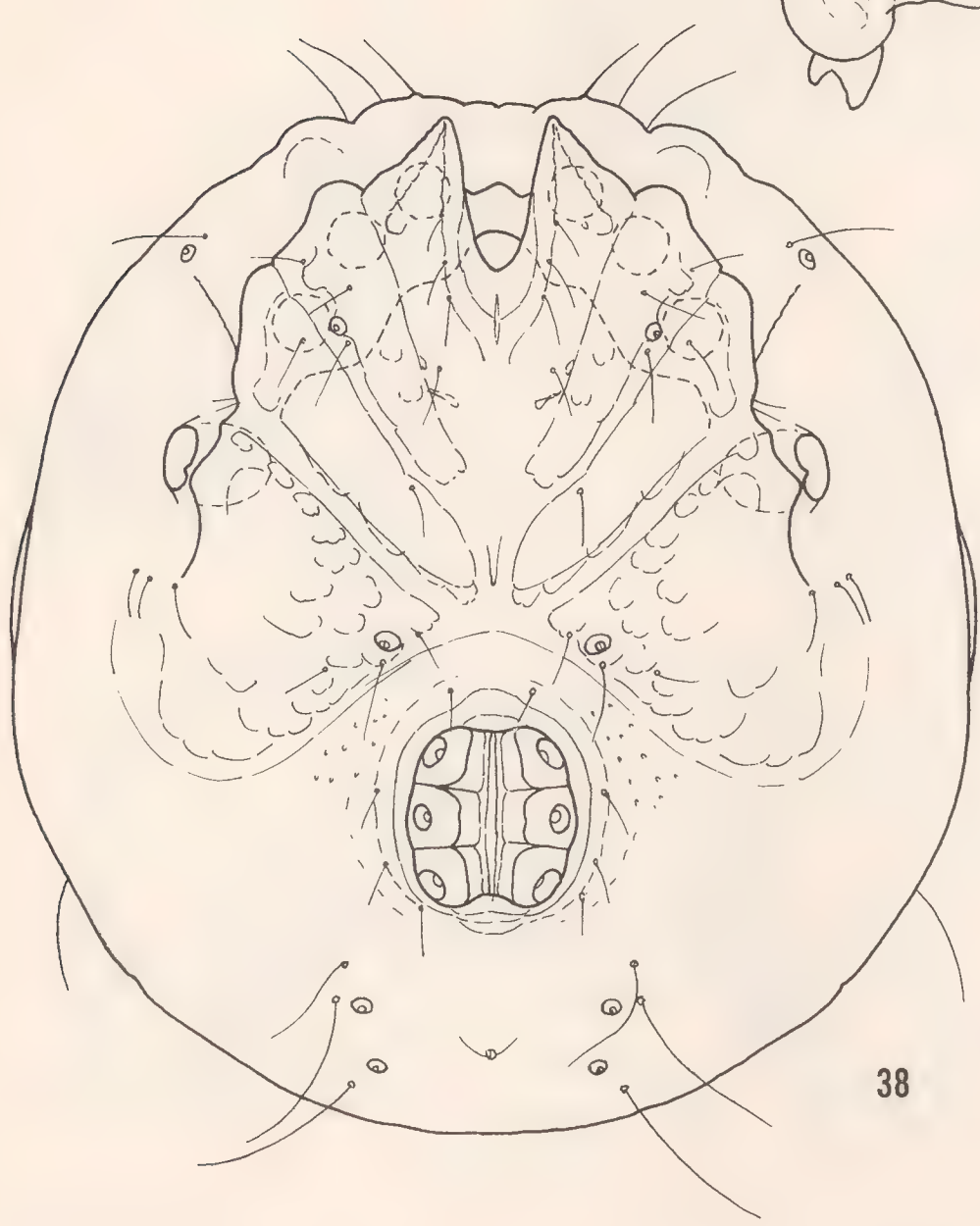


Mideopsis barri n. sp. Fig. 28, ventral shield, female; Fig. 31, palp, female.
Mideopsis crassipes Soar Fig. 29, genital field, female; Fig. 30, palp, female; Fig. 32, I-Leg-4-6, female.
Mideopsis reelfootensis (Hoff) Fig. 33, fourth leg, male.

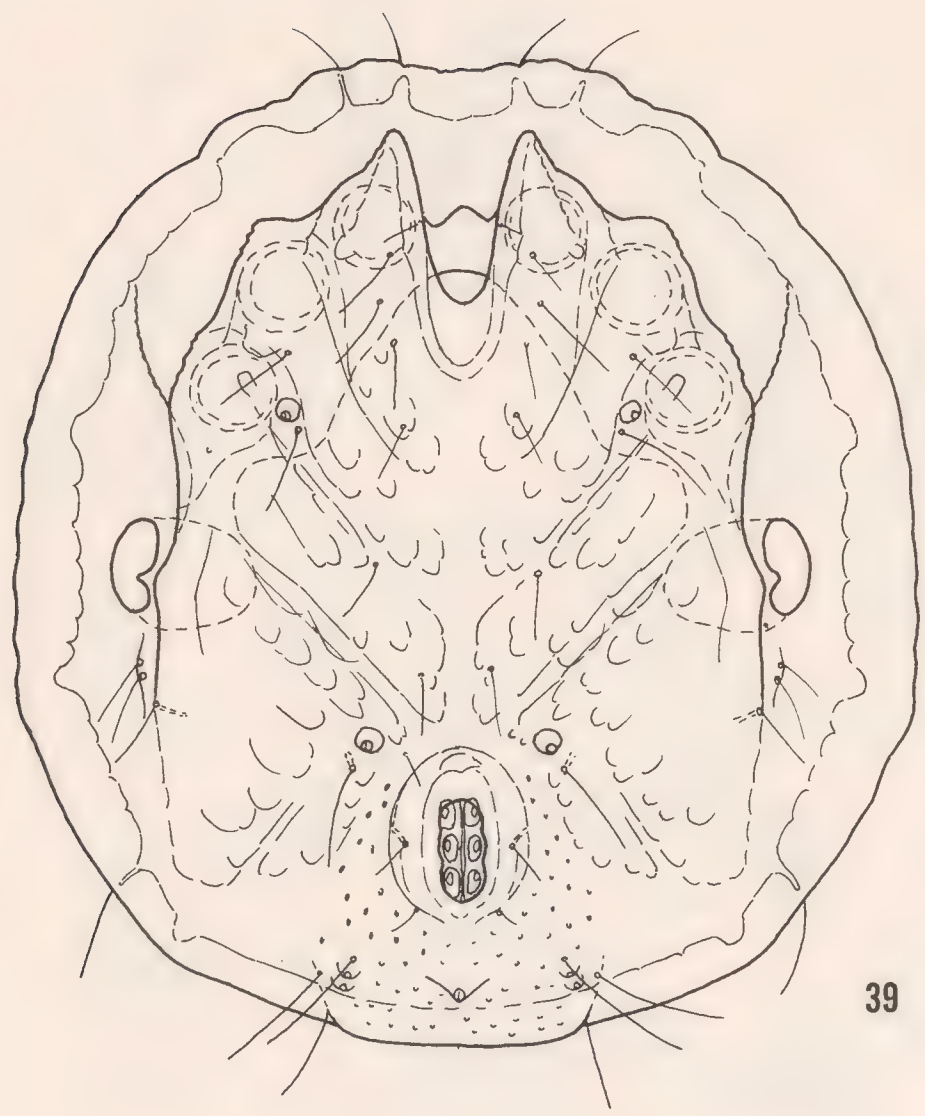


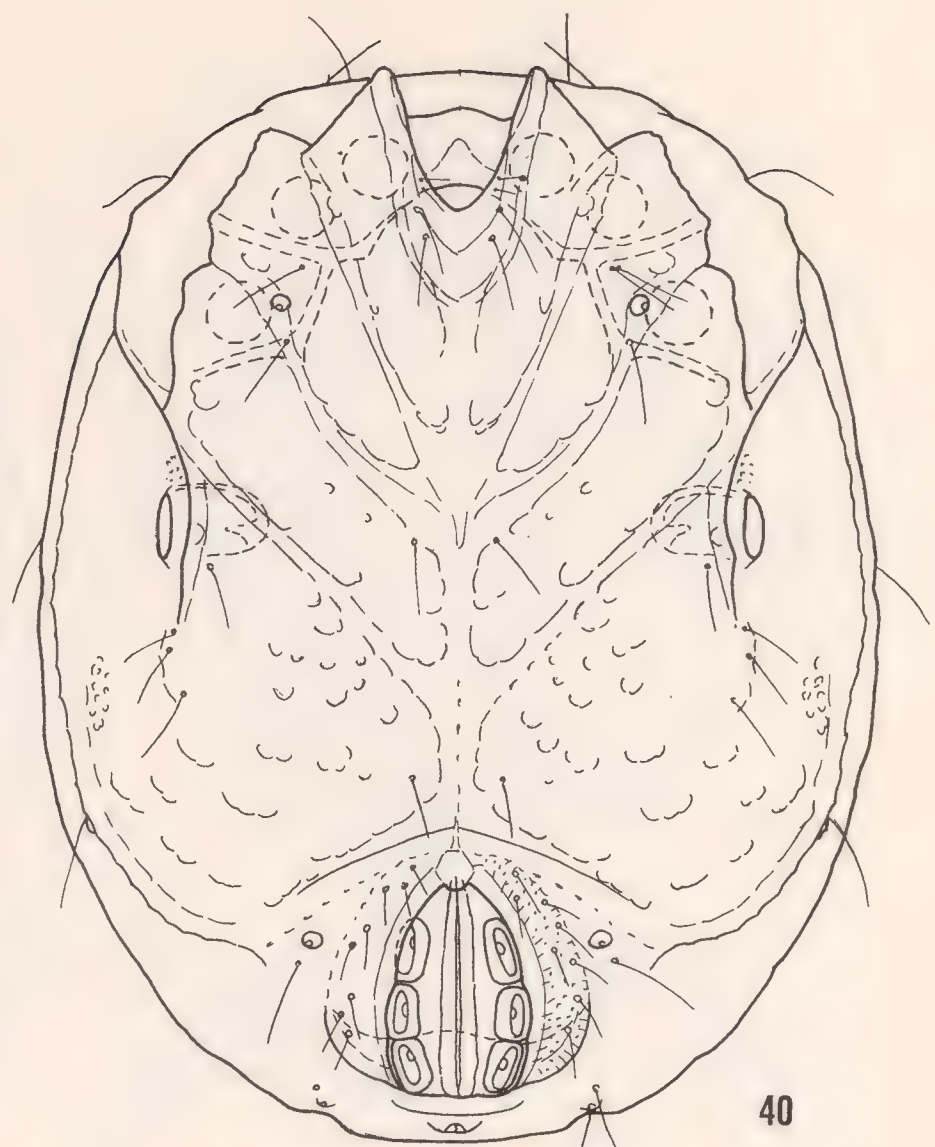


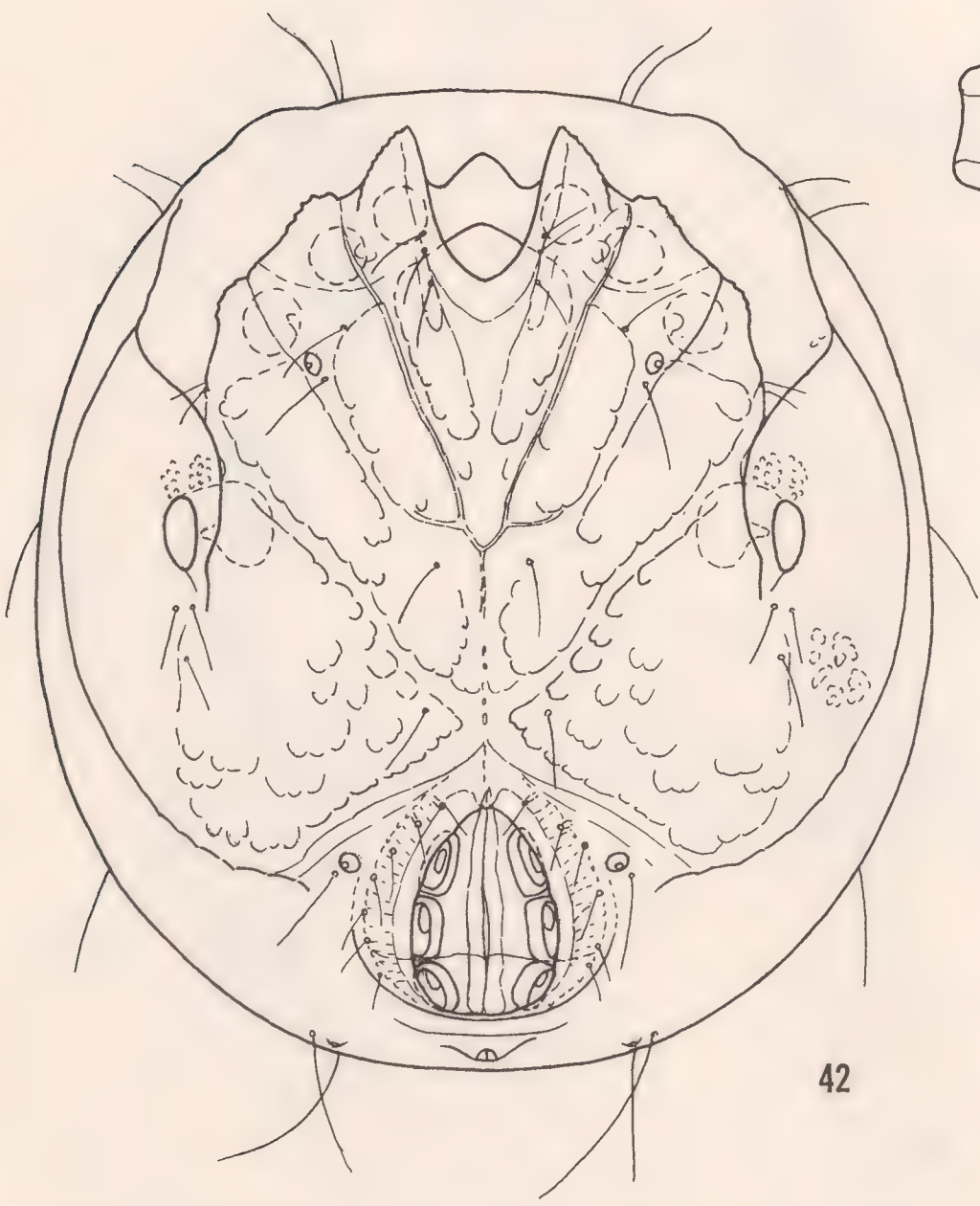


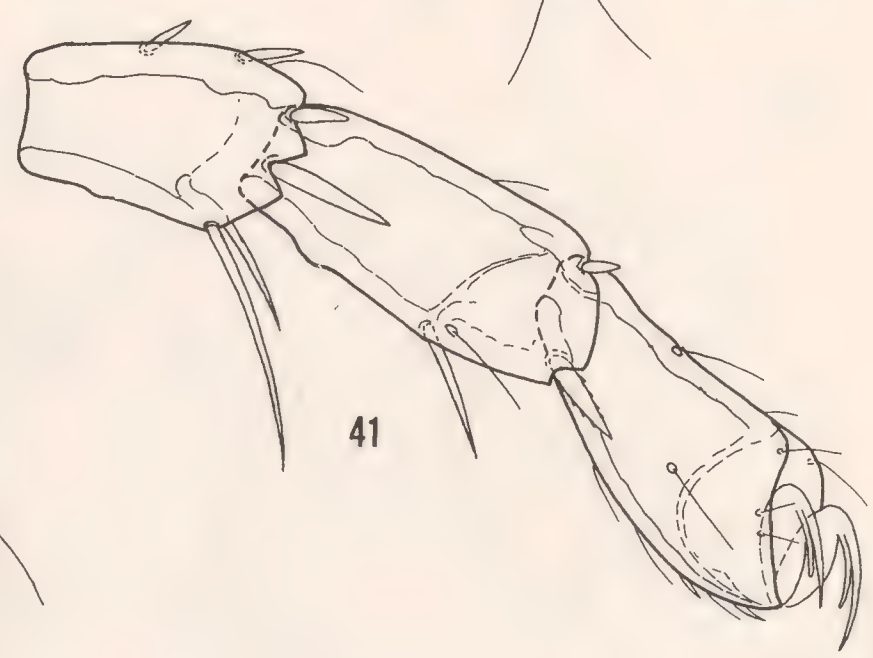


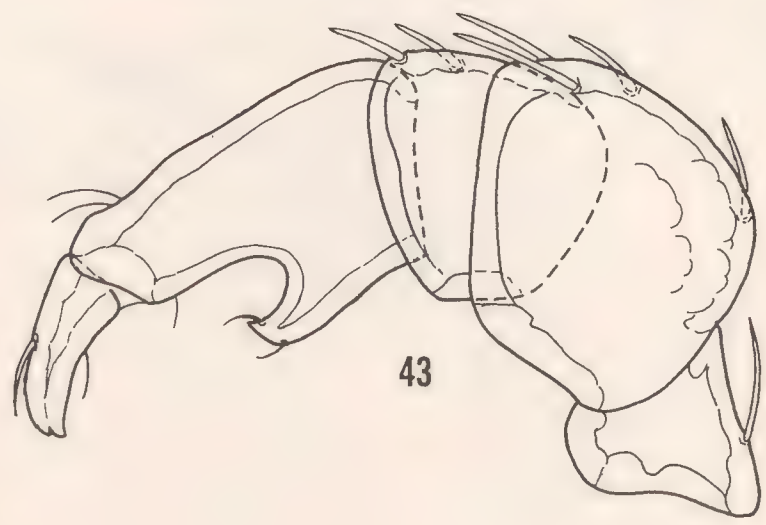
Mideopsis reelfootensis (Hoff) Fig. 34, ventral shield, male; Fig. 35, palp, female; Fig. 36, palp, male; Fig. 37, fourth leg, male; Fig. 38, ventral shield, female.



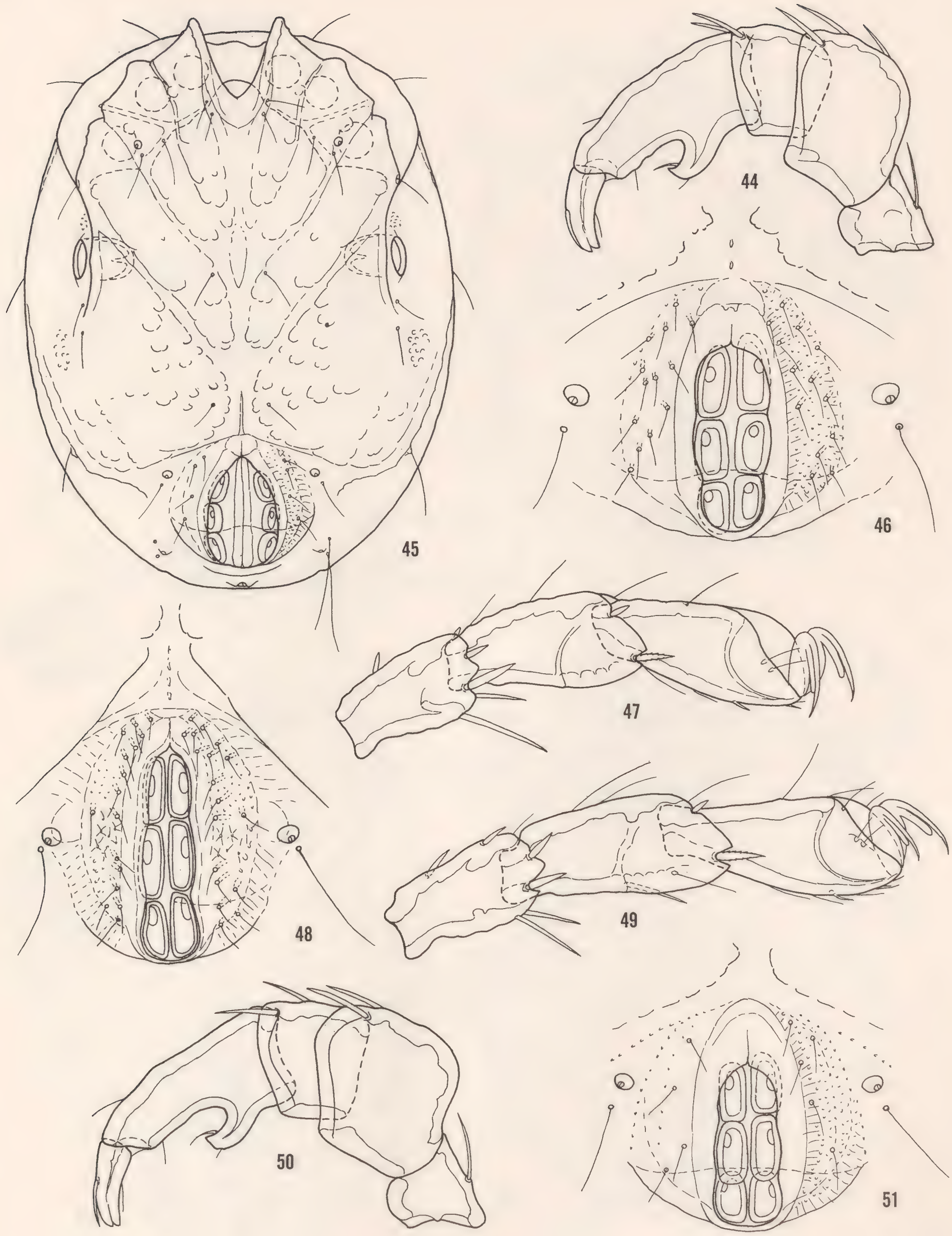




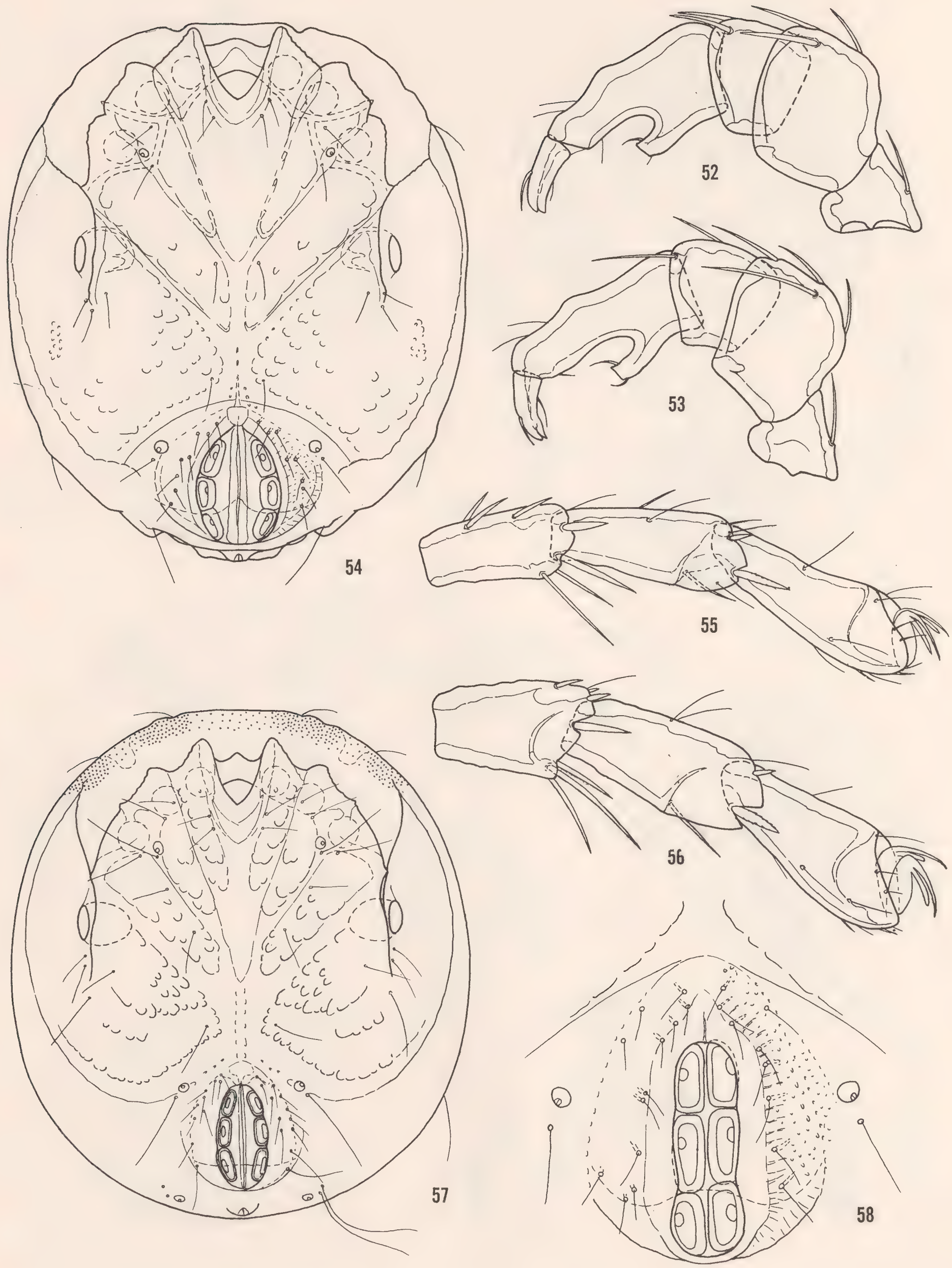




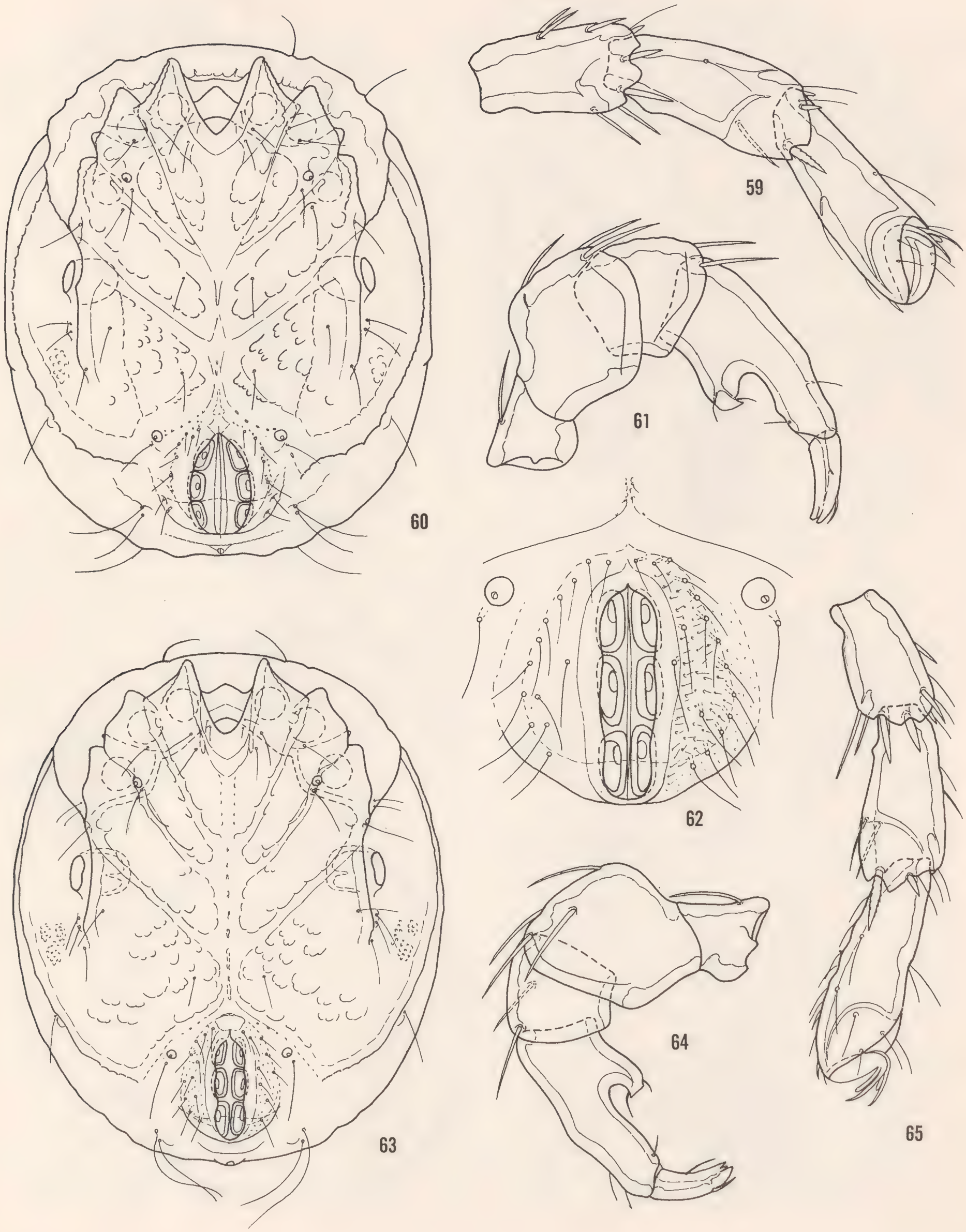
Mideopsis reelfootensis (Hoff) Fig. 39, ventral shield, male.
Mideopsis delicata (Habeeb) Fig. 40, ventral shield, female.
Mideopsis aspera (Wolcott) Fig. 41, I-Leg-4-6, female; Fig. 42, ventral shield, female; Fig. 43, palp, female.



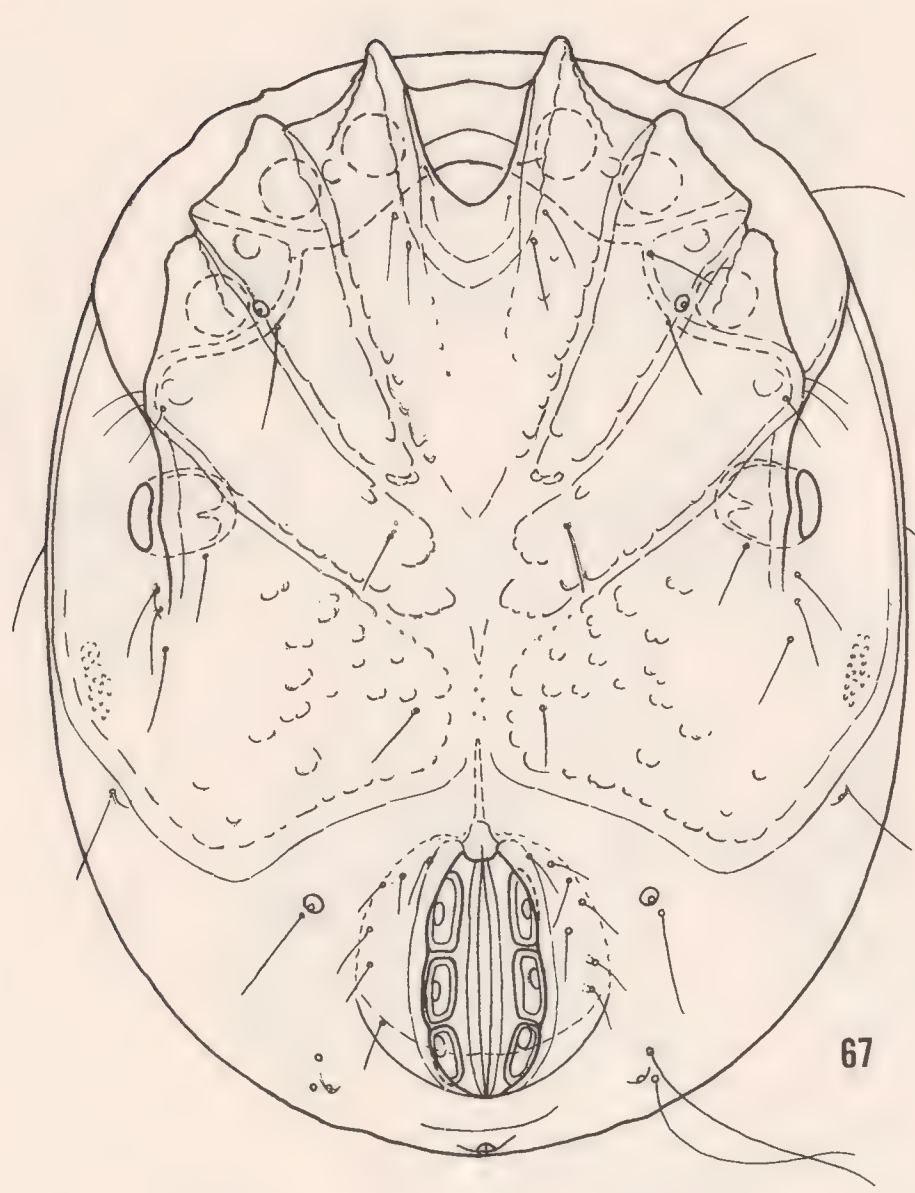
Mideopsis interstitialis n. sp. Fig. 45, ventral shield, female; Fig. 49, I-Leg-4-6, female; Fig. 50, palp, female; Fig. 51, genital field, male.
Mideopsis delicata (Habeeb) Fig. 44, palp, female; Fig. 46, genital field, male; Fig. 47, I-Leg-4-6, female.
Mideopsis aspera (Wolcott) Fig. 48, genital field, male.

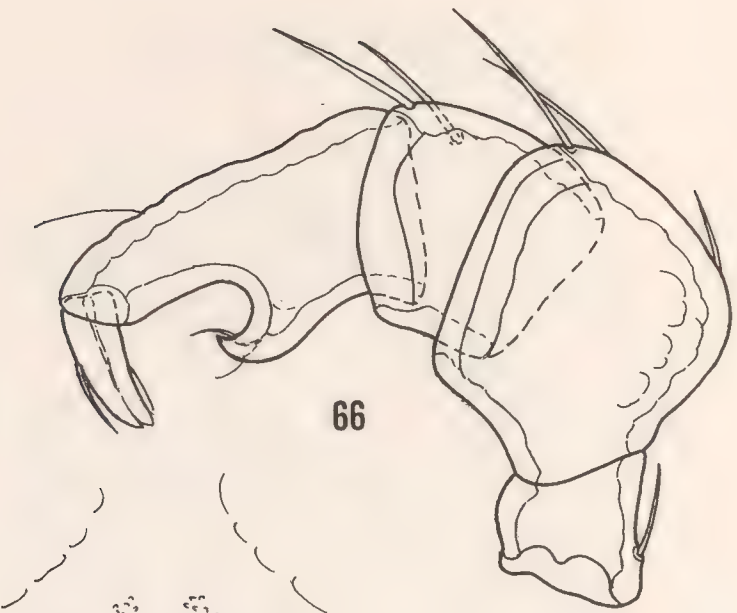


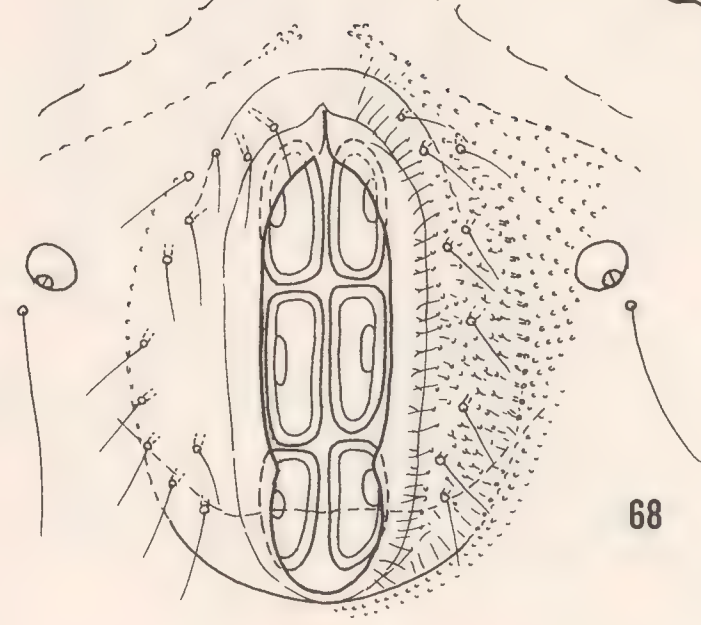
Mideopsis vicina n. sp. Fig. 52, palp, female; Fig. 54, ventral shield, female; Fig. 56, I-Leg-4-6, female; Fig. 58, genital field, male.
Mideopsis robusta (Habeeb) Fig. 53, palp, female; Fig. 55, I-Leg-4-6, female; Fig. 57, ventral shield, female.

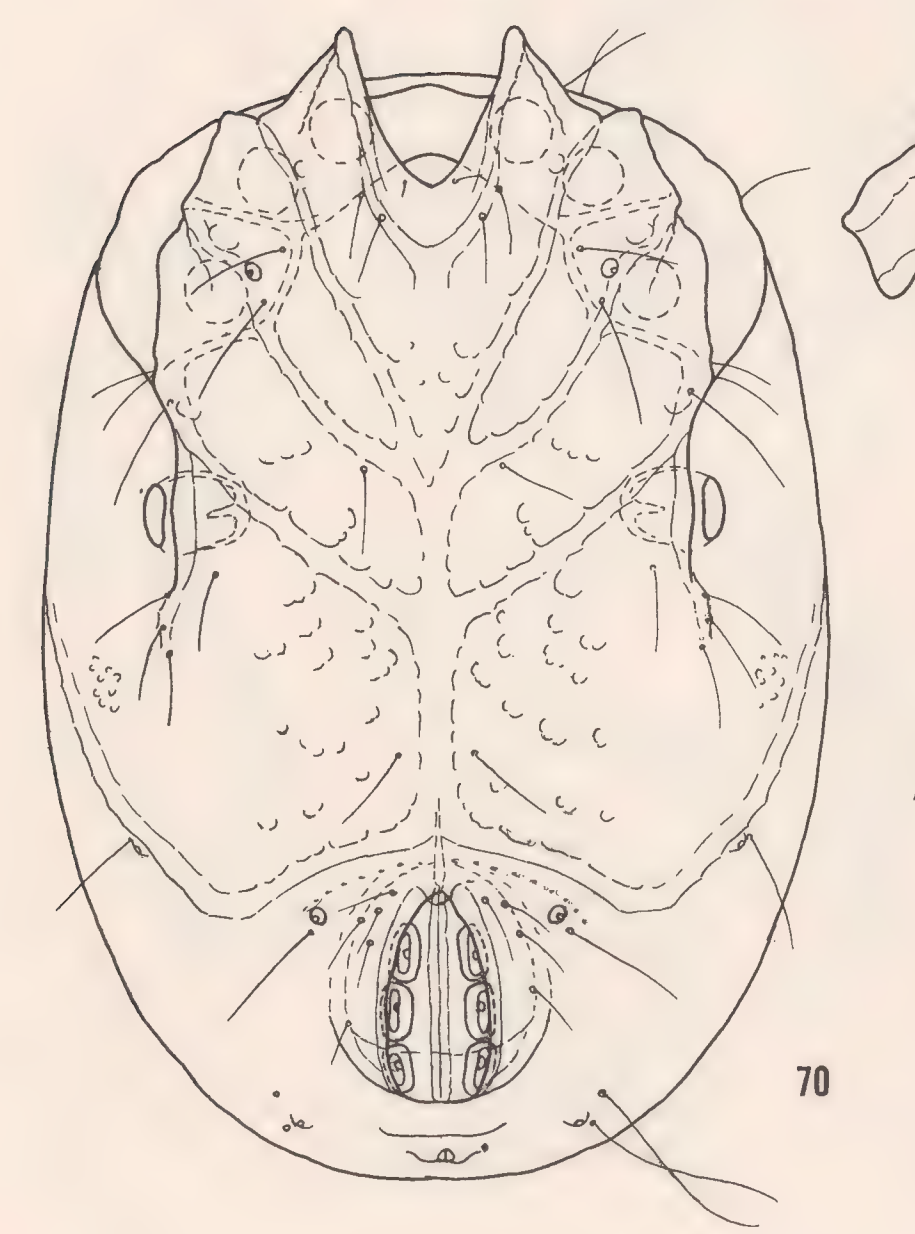


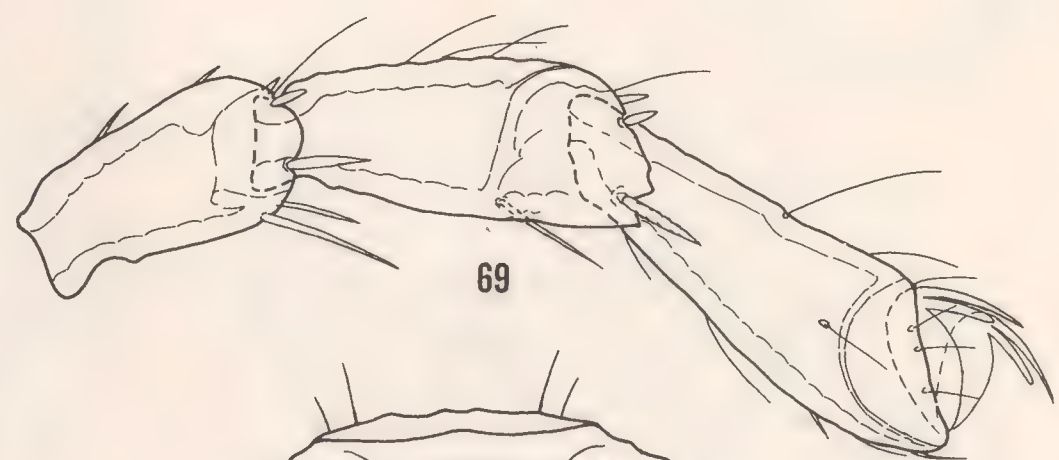
Mideopsis lamprima n. sp. Fig. 59, I-Leg-4-6, female; Fig. 60, ventral shield, female; Fig. 61, palp, female.
Mideopsis robusta (Habeeb) Fig. 62, genital field, male.
Mideopsis wolcotti n. sp. Fig. 63, ventral shield, male; Fig. 64, palp, male; Fig. 65, I-Leg-4-6, male.

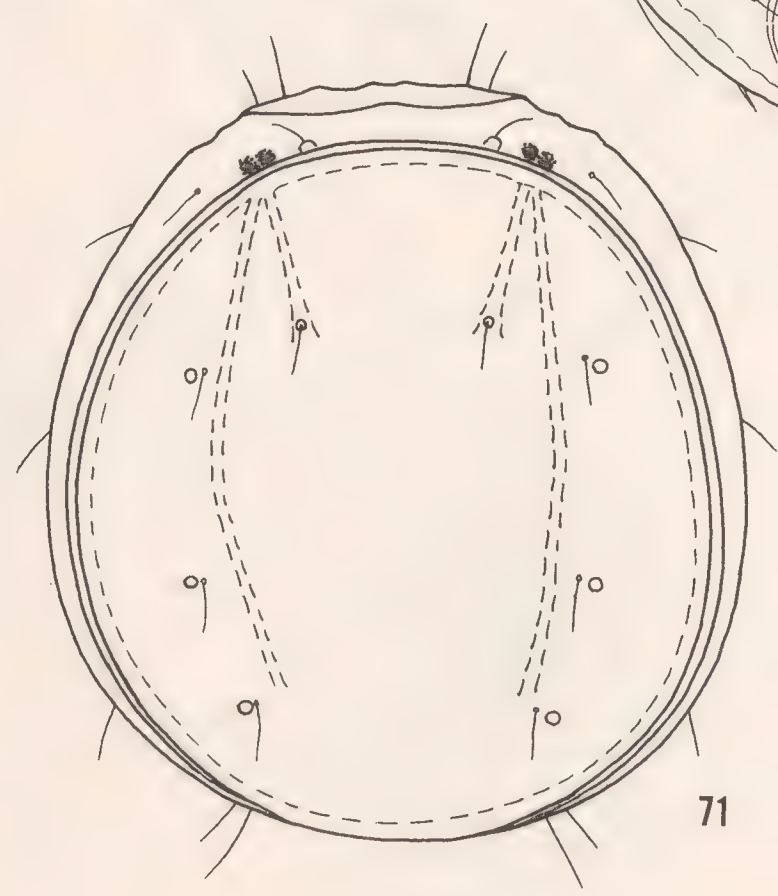




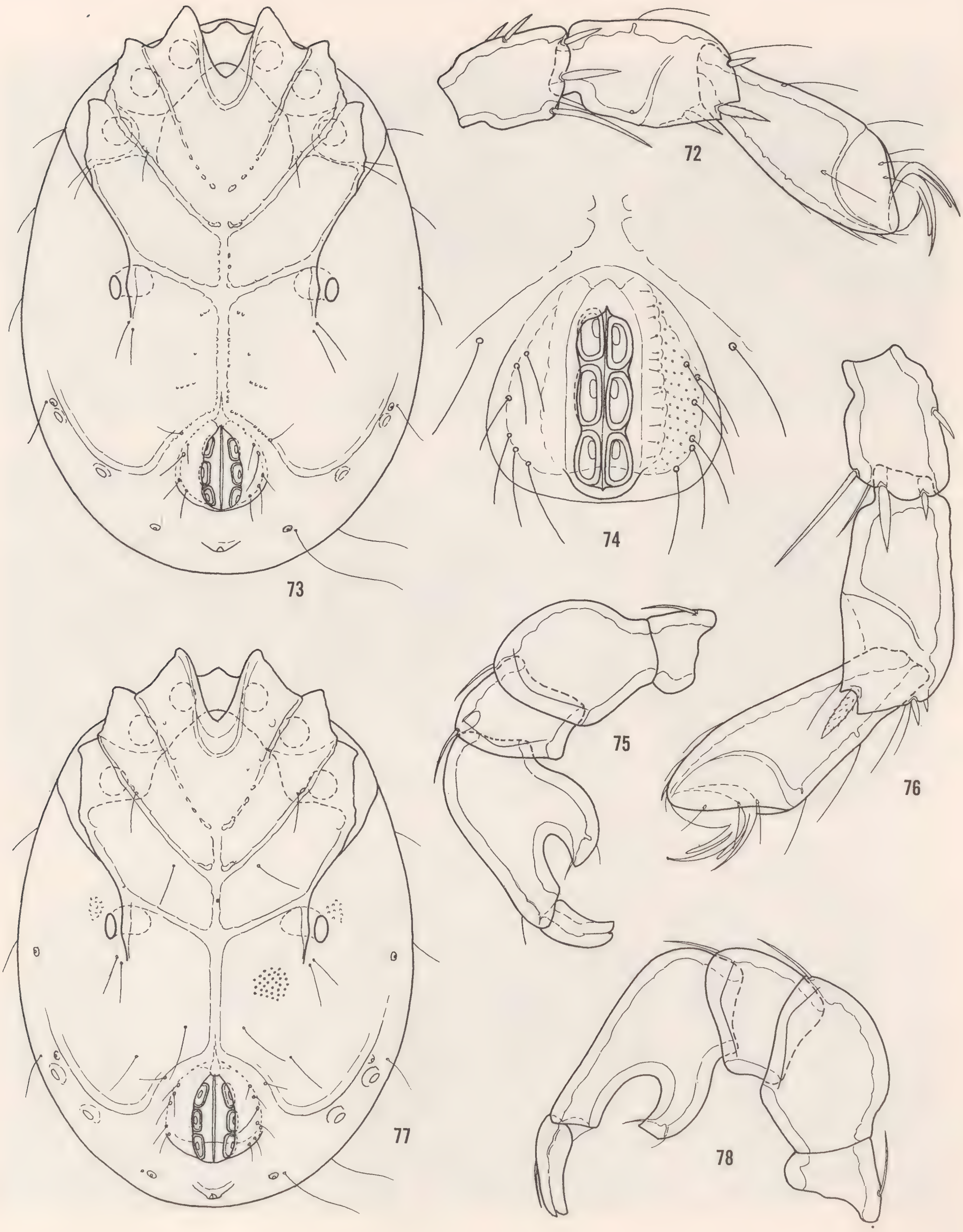




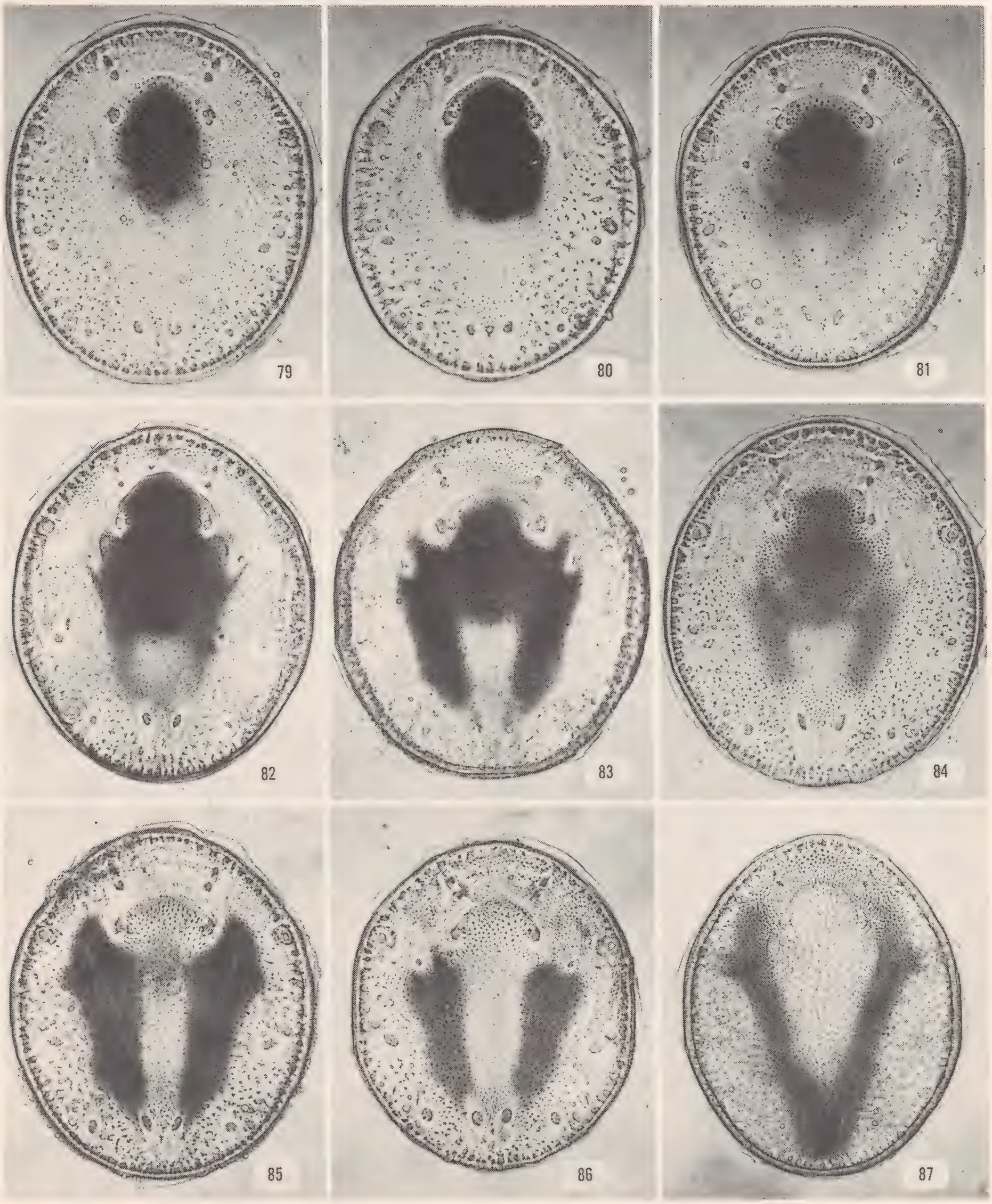




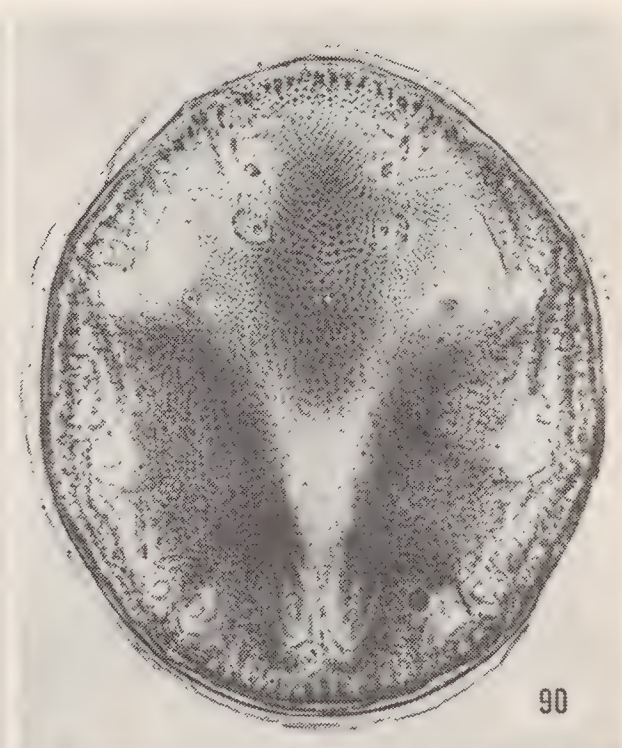
Mideopsis sabulonis n. sp. Fig. 66, palp, female; Fig. 67, ventral shield, female; Fig. 68, genital field, male; Fig. 69, I-Leg-4-6, female.
Mideopsis paramecia n. sp. Fig. 70, ventral shield, female.
Mideopsis expositor (Habeeb) Fig. 71, dorsal view, female (after Habeeb, 1963).

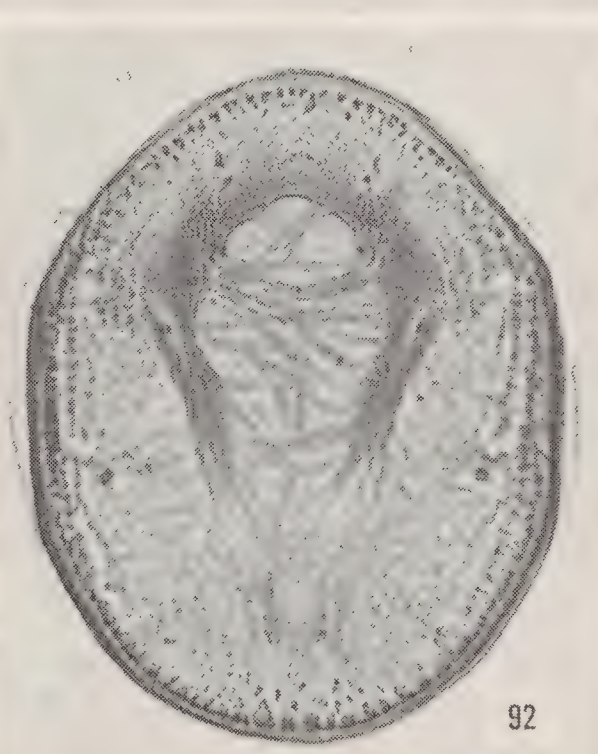


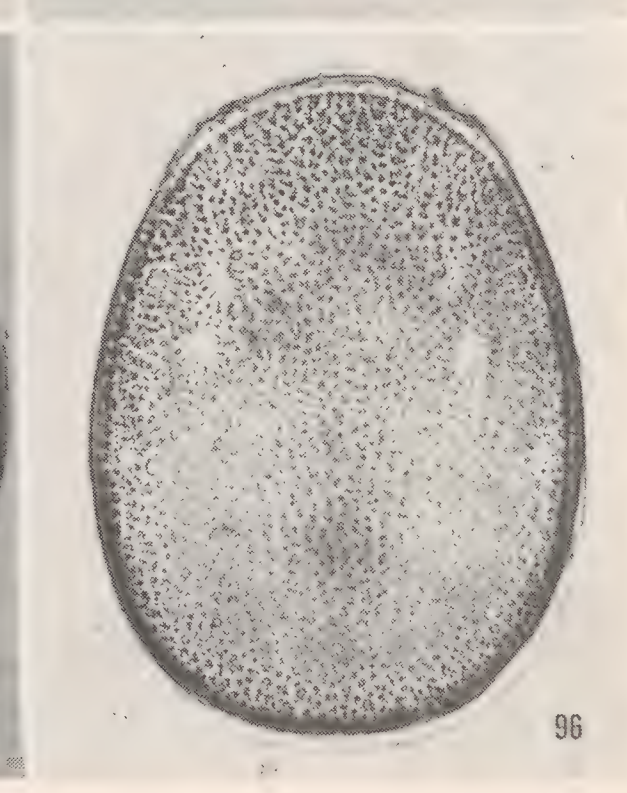
Mideopsis pumila Cook Fig. 72, I-Leg-4-6, female; Fig. 73, ventral shield, female; Fig. 74, genital field, male; Fig. 75, palp, female.
Mideopsis pallida n. sp. Fig. 76, I-Leg-4-6, female; Fig. 77, ventral shield, female; Fig. 78, palp, female.



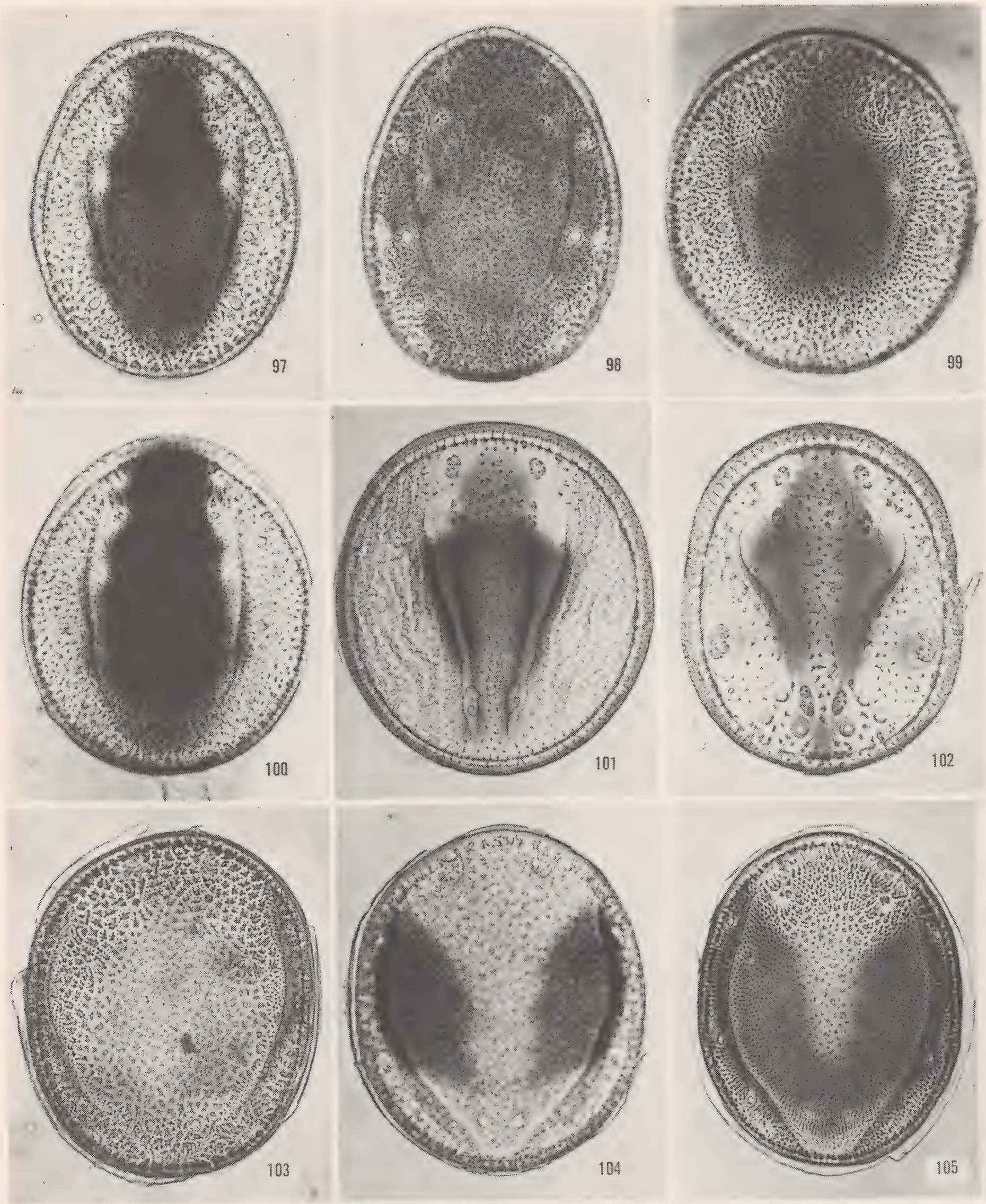
Photographs of dorsal shields. Figs. 79-86, variation found in M. borealis borealis Habeeb; Fig. 87, M. borealis californica n. ssp.



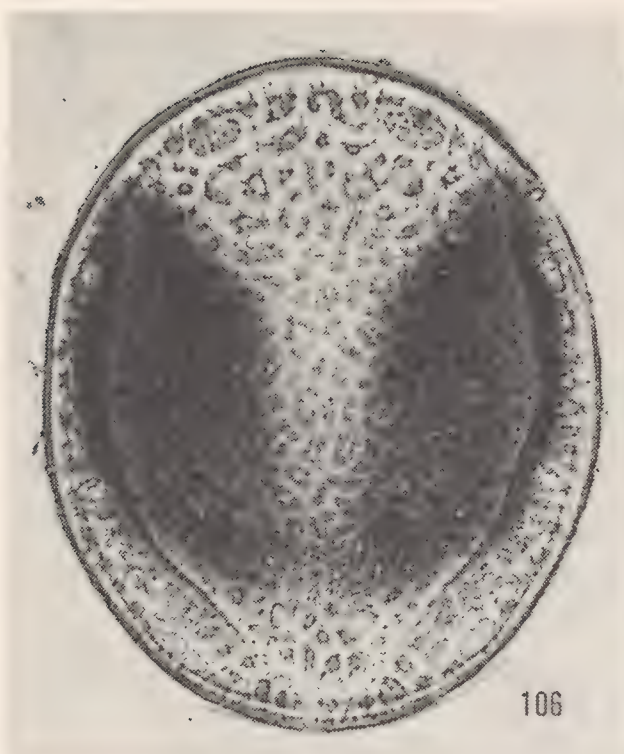


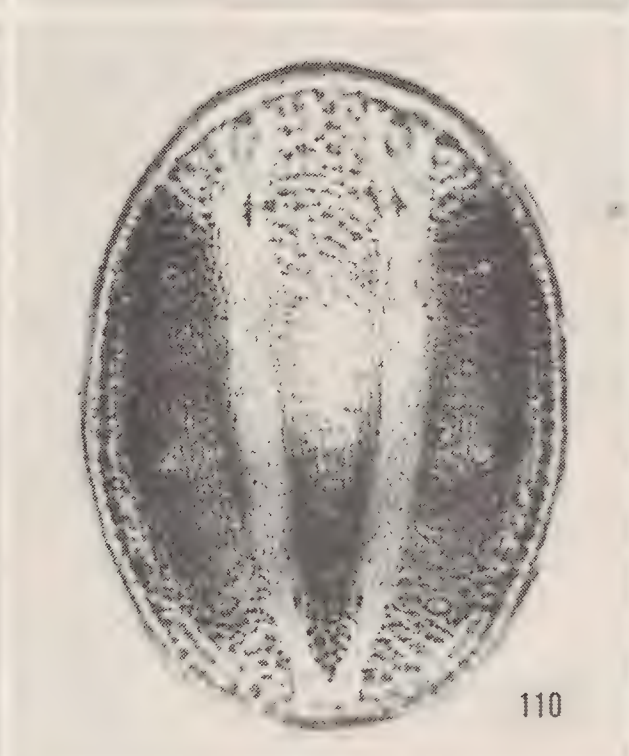


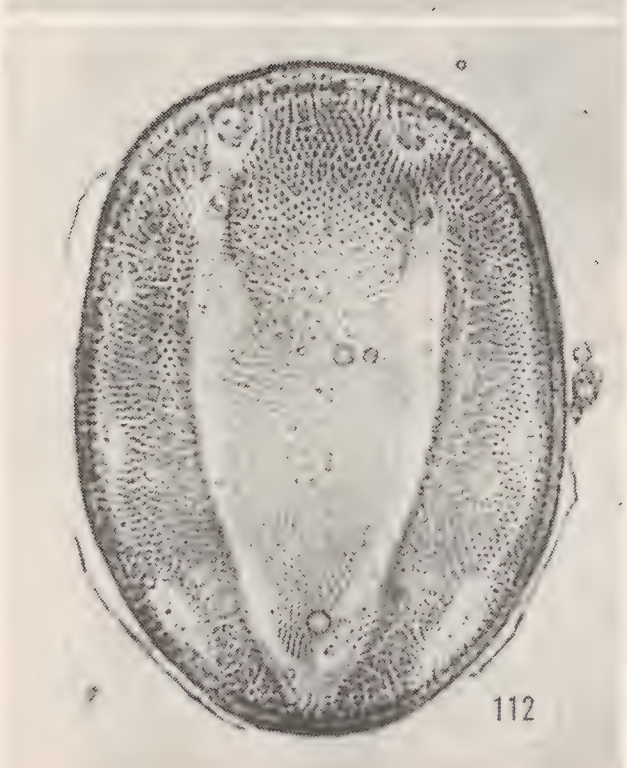
Photographs of dorsal shields. Fig. 88, M. lamellipalpis Lundblad (northern lake); Fig. 89, M. lamellipalpis Lundblad (Ozark stream); Fig. 90, M. marshallae n. sp.; Fig. 91. M. americana Marshall; Fig. 92, M. fibrosa Lundblad; Fig. 93, M. jacunda n. sp.; Fig. 94, M. olseni n. sp.; Fig. 95, M. gladiator Habeeb (female); Fig. 96, M. barri n. sp.

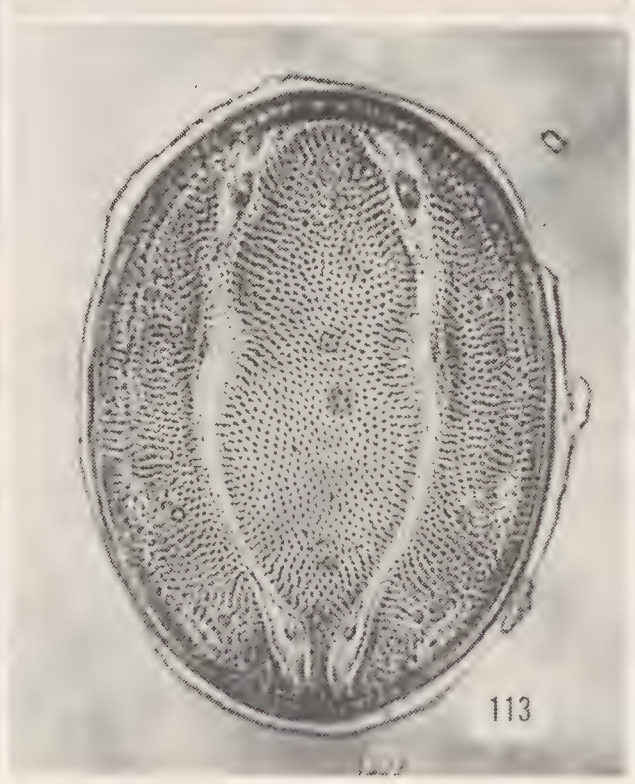


Photographs of dorsal shields. Fig. 97, M. crassipes Soar (Eastern North America); Fig. 98, M. crassipes Soar (Southern Michigan); Fig. 99, M. laversi n. sp.; Fig. 100, M. crassipes Soar (New Mexico specimen); Fig. 101, M. reelfootensis (Hoff) (female); Fig. 102, M. reelfootensis (Hoff) (male); Fig. 103, M. aspera (Wolcott) (type); Fig. 104, M. aspera (Wolcott) (Ontario); Fig. 105, M. delicata (Habeeb).









Photographs of dorsal shields. Fig. 106, M. vicina n. sp.; Fig. 107, M. interstitialis n. sp.; Fig. 108, M. wolcotti n. sp.; Fig. 109, M. lamprima n. sp.; Fig. 110, M. robusta (Habeeb); Fig. 111, M. sabulonis n. sp.; Fig. 112, M. paramecia n. sp.; Fig. 113, M. pumila Cook; Fig. 114, M. pallida n. sp.

*An asterisk indicates a synonym.
The main reference is underscored.